

**NATIONAL RENEWABLE ENERGY LABORATORY**  
**ENVIRONMENTAL PERFORMANCE REPORT for 2003**

**(Annual Site Environmental Report per DOE Orders 231.1 and 5400.5)**

Prepared by:  
Environment, Safety & Security Office  
National Renewable Energy Laboratory

NREL is a national laboratory of the  
U.S. Department of Energy and is  
Operated by Midwest Research Institute and Battelle

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## 1 INTRODUCTION

The National Renewable Energy Laboratory (NREL) is a U.S. Department of Energy (DOE) national laboratory, and conducts research primarily for DOE's Office of Energy Efficiency and Renewable Energy (EERE). The Midwest Research Institute and Battelle operate NREL under the oversight of the DOE Golden Field Office (GO). NREL is the nation's premier laboratory for renewable energy research and development and a leading laboratory for energy efficiency research, with programs in wind energy, solar energy, plant and waste-derived fuels and chemicals, energy efficiency in buildings, geothermal energy, advanced vehicle design, and hydrogen infrastructure and fuel cells.

### Purpose

This report presents a summary of NREL's environmental protection programs and activities for 2003. It is organized according to the different environmental media (e.g. air, waste, ground water, etc.), and includes a brief summary of how the program is managed in that area, any permitting or notification efforts that have been completed during the reporting period or are ongoing, and activities that have occurred during the reporting period in that environmental area. A description of the environmental condition and features of NREL's sites is also included to provide a basis for the program overview.

This report is generally organized to present many of the elements of the Global Reporting Initiative (GRI) Sustainability Reporting Guidelines. It also incorporates DOE guidelines for the 2003 Annual Site Environmental Report, as required by DOE Orders 231.1 and 5400.5.

### Background

NREL's mission: NREL develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals.

NREL fulfills its mission through technology portfolios; a brief description of each major technology area follows.

*Photovoltaics:* Photovoltaics is the direct conversion of sunlight to electricity using solid-state materials. The National Center for Photovoltaics develops and deploys photovoltaic (PV) technology for the generation of electric power.

*Wind Energy:* Through the National Wind Technology Center (NWTC), NREL develops, improves, and demonstrates the viability of wind technology for electricity generation and facilitates its deployment throughout the world

*Bioenergy:* NREL currently has major programs in both biomass-derived fuels (biofuels) and biomass-derived electricity (biopower), and projects in biomass-derived chemicals and materials.

*Renewable Thermal Technologies:* These technologies generate power from heat or utilize heat from renewable resources. They include concentrating solar power, solar water heating, and geothermal heat and power.

*Distributed Power:* Distributed power is modular electric generation or storage located near the point of use. NREL participates in the development of technologies, market structures, and policies that affect the incorporation of renewables and energy efficiency technologies in distributed power systems, maximizing the deployment of renewable energy and energy efficiency products. As a part of this initiative, NREL is involved in the development, design, and deployment facilitation of renewable and renewable/fossil hybrid distributed power systems in grid-connected applications.

*Building Energy:* NREL increases the use of energy efficiency technologies and expands the use of renewable energy technologies in the building sector by working to develop new, cost-effective, and environmentally acceptable building equipment and envelope systems.

*Hydrogen:* NREL serves as a leader in renewable hydrogen production technologies as well as in advanced storage and sensor development, and codes and standards development. Basic and applied research and material development using biology, physics, and chemistry enable and support the development of hydrogen production, storage, and end-use systems.

*Transportation:* NREL works with industry to develop advanced vehicles and systems for transportation, and to develop viable vehicle systems that are integral to DOE transportation initiatives. NREL also works with energy companies and manufacturers of vehicles and engines to develop advanced motor vehicle fuels for improved energy and environmental performance. A systems approach is used to develop optimized engine management, fuel, and emission control technologies.

*Basic Science:* Fundamental research is conducted in the sciences that underlie NREL's renewable energy and energy efficient technologies.

*Computational Sciences:* This area includes basic and applied research using high-performance computing and applied mathematics.

*Electricity Technologies:* These technologies include renewable energy, hydrogen, and superconductivity technologies, plus utility resources.

*Energy Analysis:* Research at NREL includes energy analysis for various programs and initiatives.

*Measurements and Testing:* NREL labs and facilities allow state-of-the-art testing on photovoltaic cells, building technologies, and wind turbines.

*Renewable Energy Resources:* Researchers find resource information for solar, wind, biomass, and geothermal energy applications.

### Site and Facility Description

NREL facilities occupy five separate locations in Jefferson County, Colorado, near the city of Denver. The five facilities are the Denver West Office Park (DWOP), the South Table Mountain site (STM), the Joyce Street Facility (JSF), the National Wind Technology Center (NWTC), and the Renewable Fuels and Lubricants Research Laboratory (ReFUEL). The DWOP and STM sites are approximately 2 miles (3.2 km) east of Golden and 12 miles (19.3 km) west of central Denver. The NWTC is located near the intersection of Highways 93 and 128, between Boulder and Golden, and is approximately 15 miles (24.2 km) north of the STM site. It is adjacent to the DOE Rocky Flats Environmental Technology Site. The JSF is located at 6800 Joyce Street, approximately 5.5 miles (8.9 km) north of the DWOP and STM sites. The ReFUEL Facility is located with the Regional Transportation District (RTD) District Shops and Operation Center (DSOC) located at 1900 31<sup>st</sup> Street, Denver, about 12 miles east of the STM and DWOP sites. Figure 1.1 illustrates the locations of the STM, DWOP, NWTC, and JSF sites on a regional map. The location of the ReFUEL Facility is shown on Figure 1.2. Figure 1.3 provides a more detailed map of the STM site, and Figure 1.4 provides detail for the NWTC site.

The STM and NWTC sites are the two main sites where research operations are conducted. These two sites will be addressed separately in the discussion of environmental features. The DWOP is leased space used primarily for administrative functions and limited research activities. The JSF is also a leased space that is currently used for storage. The ReFUEL Facility is a leased facility that consists of a small shop complex housed within the RTD/DSOC facility. NREL performs engine-testing activities pertaining to fuels and lubricants at the site.

**Figure 1.1 – Regional Map**

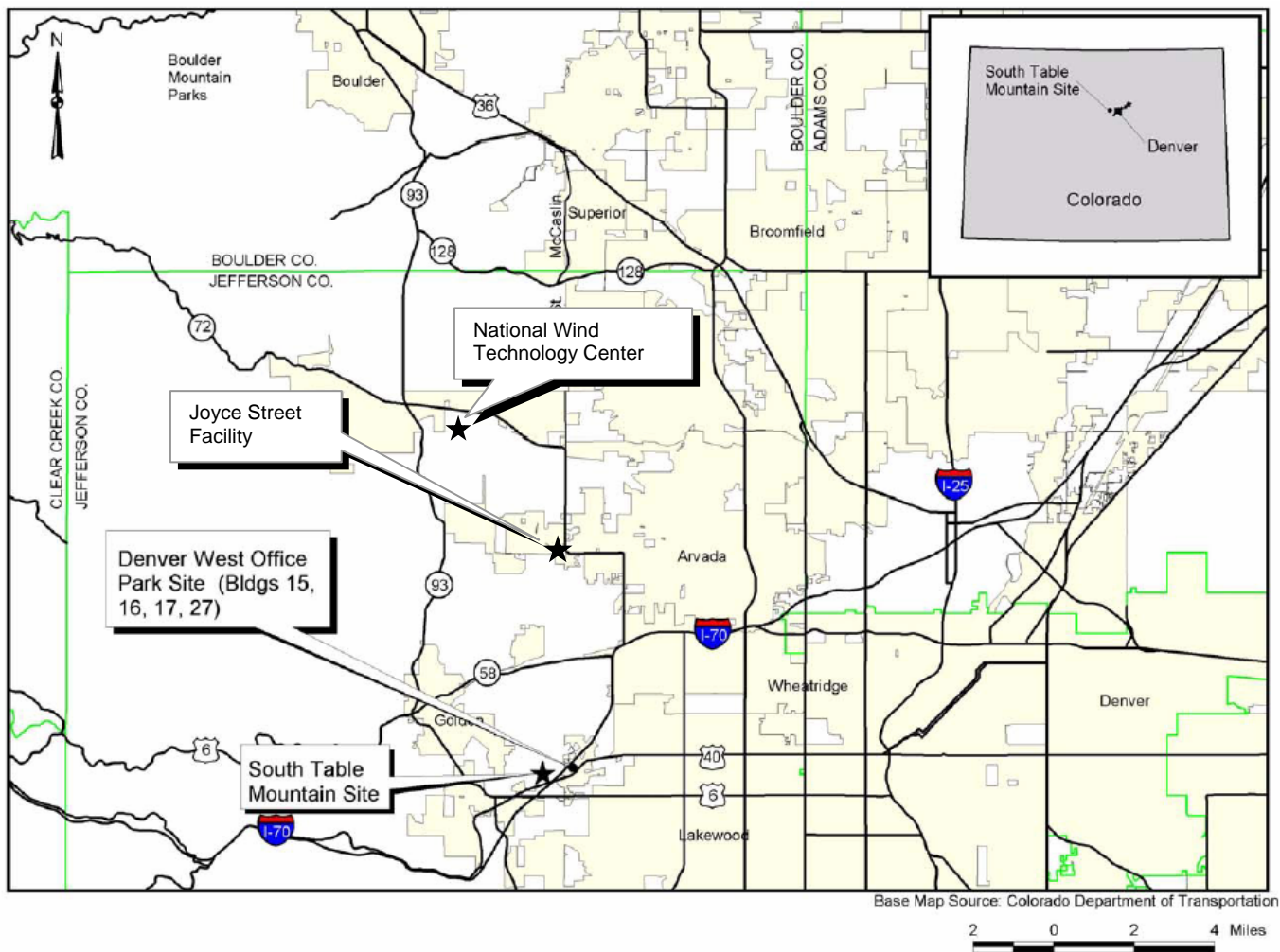


Figure 1.2 – ReFUEL Facility Location Map

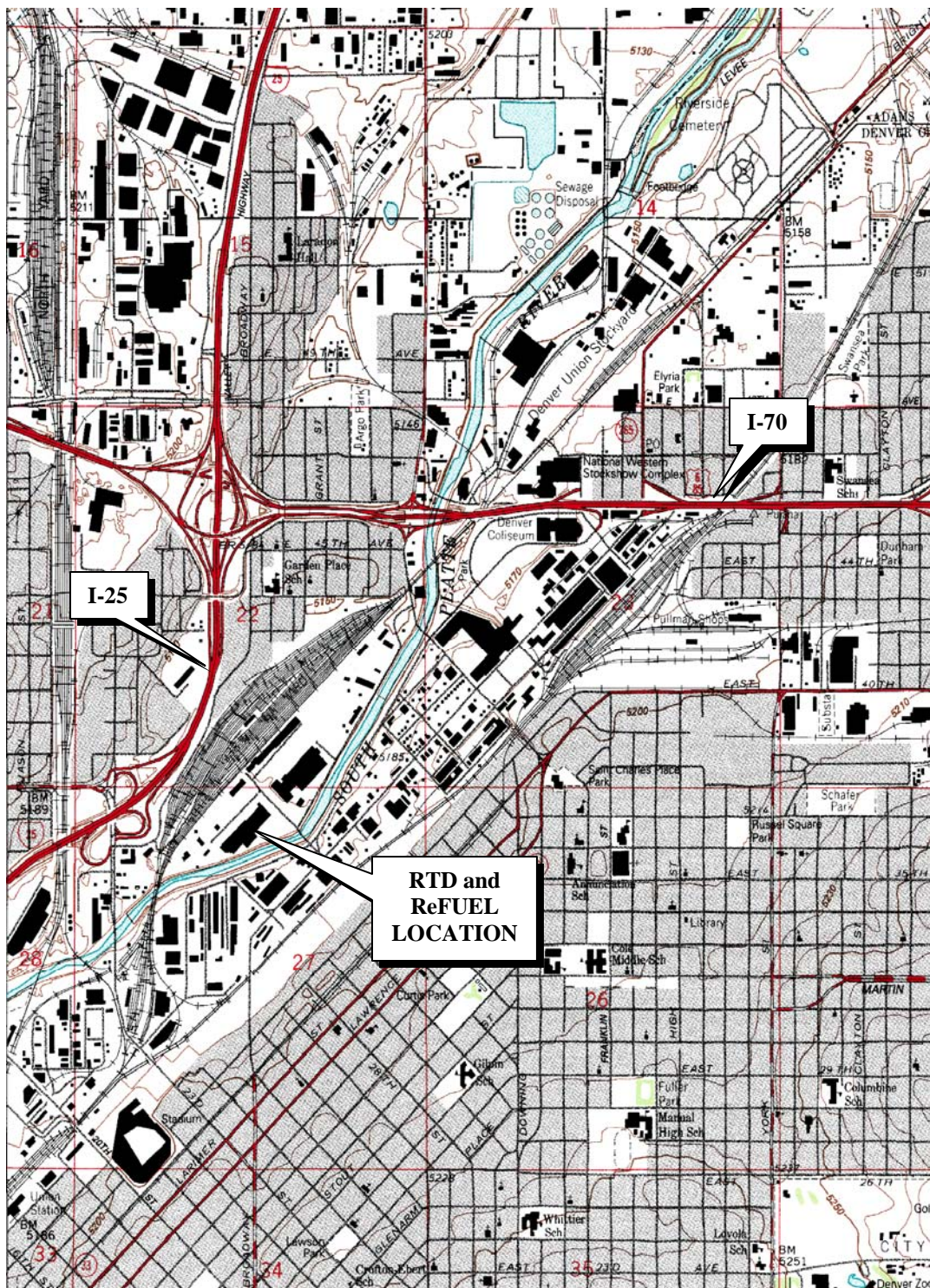


Figure 1.3 – STM Site Map

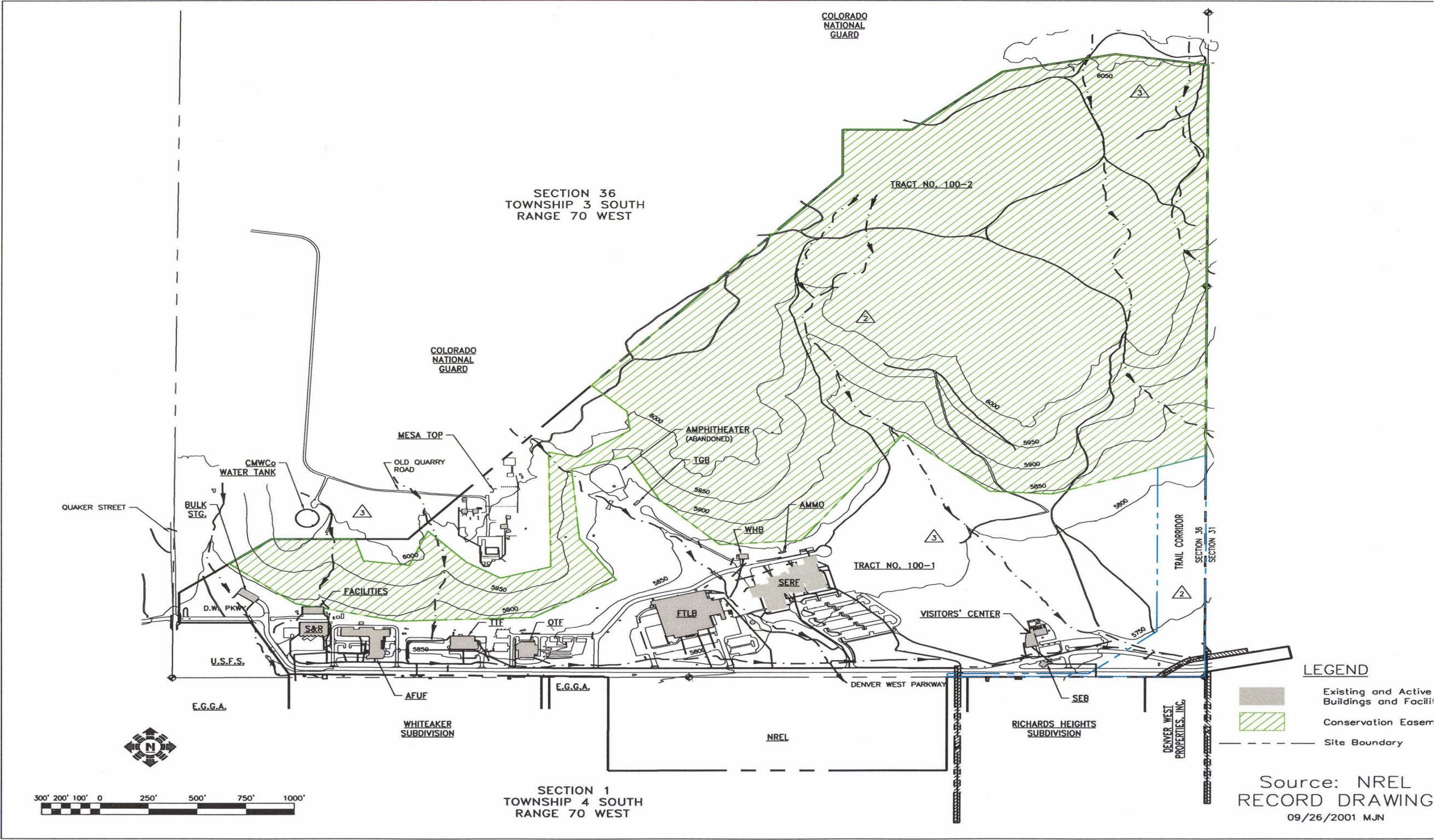


Figure 1-3 South Table Mountain Site Map

**Figure 1.4 – NWTC Site Map**

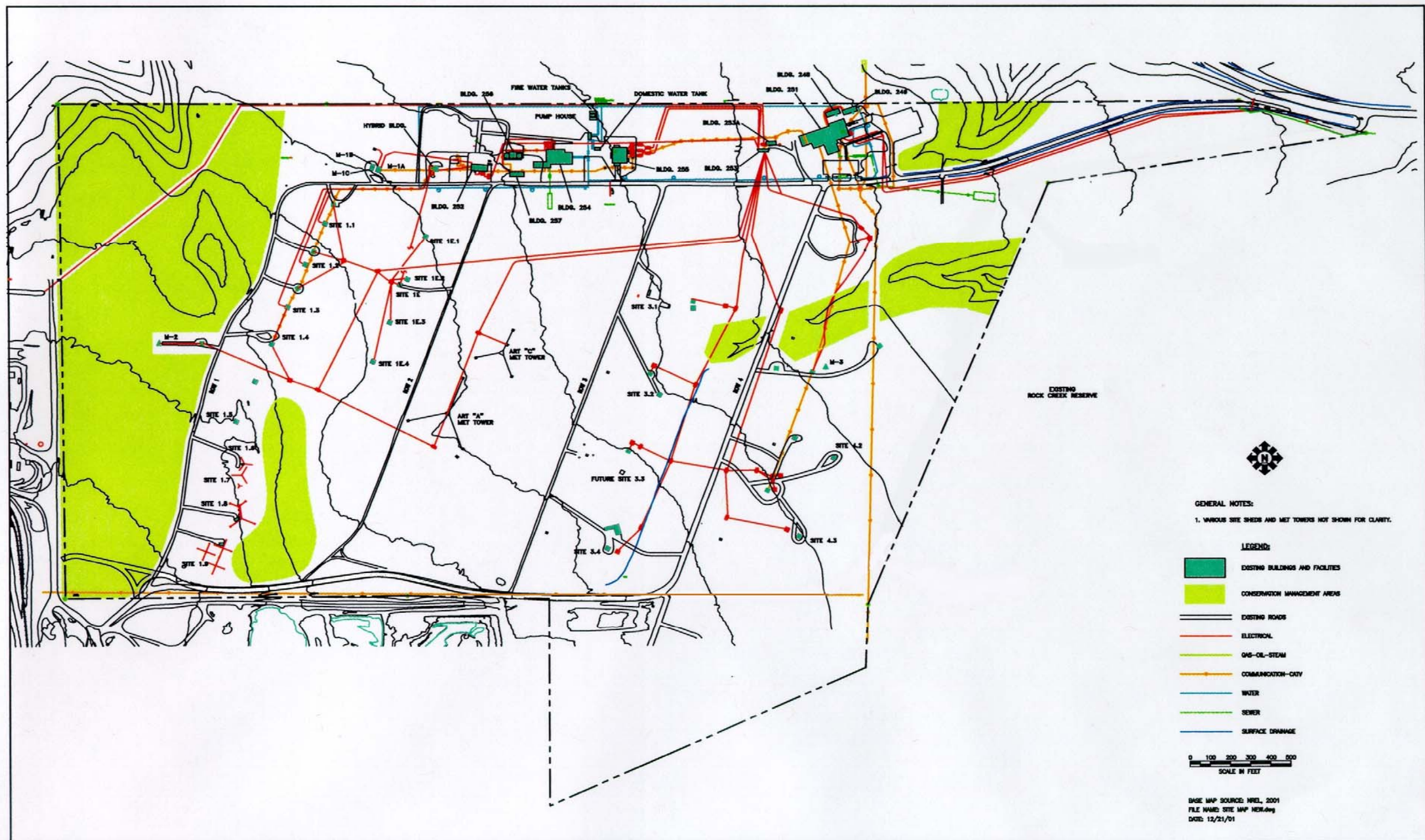


Figure 1-4 Site Map

### Site Environmental Conditions/Features

Photos for each site documenting the site features and development, as they existed during 2003, are included at the end of this section. Figures 1.5, 1.6, 1.7 and 1.8 illustrate the South Table Mountain and Denver West Office Park sites, and Figures 1.9 and 1.10 illustrate the National Wind Technology Center site. The views on the STM site also illustrate the Conservation Easement property and the Camp George West property acquired in 1999.

### Climate

The climate for the geographic region of NREL operations is classified as semi-arid, typified by limited precipitation, low relative humidity, abundant sunshine, and large daily and seasonal temperature variations.

The area experiences moderate precipitation, with average annual rainfall less than 50 cm (20 in). Almost half of the annual precipitation occurs from March to June. Summer showers contribute 33% of the annual precipitation total. Precipitation begins to decrease significantly in the fall, and reaches the minimum during winter. Winter is the driest season, contributing less than 10% of the annual precipitation, primarily in the form of snowfall.

Spring is a season of unstable air masses with strong winds along the foothills and the Front Range. The highest average snowfall occurs in March, and the STM site can generally expect to experience at least one heavy snowstorm with totals exceeding 15 to 25 cm (6 to 10 in.).

The solar radiation (sunlight energy) of the region is excellent for outdoor research and testing of solar energy conversion devices and systems. Sunshine is abundant throughout the year and remarkably consistent from month to month and season to season.

#### ***1.1 South Table Mountain Site***

##### Geology, Soils, and Hydrogeology

The STM site is a roughly triangular parcel of land occupying portions of the top, sides, and lower south-facing slopes of South Table Mountain. South Table Mountain is composed of sedimentary rocks below a basalt lava cap, which is quite resistant to erosion. The South Table Mountain feature is a mesa that stands about 150 meters above the adjacent lowlands. The mesa was formed as weak sedimentary rocks surrounding the lava were eroded away, leaving the lava-capped mesa in relief. Below the lava caprock, the sedimentary rocks are part of the Denver Formation that consists of layers and lenses of claystone, sandstone, and conglomerate. Sedimentary rocks of the Arapahoe Formation underlie the Denver Formation.

Both the Arapahoe and Denver Formations are considered to be aquifers in portions of the Denver Basin. The Denver Formation underlies the areas on which most NREL construction has taken place. Groundwater on the STM site occurs primarily in the weathered and fractured silts and sands of the Denver Formation. There may also be some groundwater in the form of perched aquifers below the basaltic lava cap on the South Table Mountain and within the materials above the Denver Formation, which are largely the result of stream deposits. Groundwater flow on the site is in a southeasterly direction.

The soil covering the top of South Table Mountain is Lavina Loam. A loam is composed of a mixture of clay, sand, silt, and organic matter. The loam on the mesa top is a shallow, well-drained clayey soil. Soil on the upper side slopes of South Table Mountain is also a loam consisting of extremely stony soils with significant amounts of clay. Much of the remainder of the site, including the area designated for major development, has a deep, well-drained soil referred to as Denver clay loam. It consists of clayey material containing some calcium carbonate. There are also two smaller soil areas on the southwestern portion of the site, both of similar character to other site soils: cobbly clay loam and very stony clay loam.

#### Surface Water

About 90% of the surface drainage off the site, both the mesa top and across the lower portions of the site, is in the southerly direction toward Lena Gulch (a tributary of Clear Creek). Surface water from two drainage ways on the easternmost portion of the site ultimately flows into Lena Gulch.

There is no permanent stream flow on the STM site. Only occasional flow derived from extended periods of precipitation, usually during the late winter and early spring, is found in the drainage channels with seasonal springs evident along some of the mesa slopes. There is one seep on the mesa top that is often active throughout much of the year, but the water infiltrates and evaporates quickly during the dry season.

#### Vegetation

Two primary vegetation types are present on the STM site: grasslands and shrublands. The most common plant communities on the STM site are mixed grasslands, comprising over 80% of the vegetation on the site. These communities are generally dominated by short- and mid-grass species. Two primary upland shrub communities occur on the STM site: mountain mahogany shrublands, found on the shallow soils of the mesa, and upland shrublands, occurring in drainages lacking active channels as well as drainages with associated wetlands. Recent field surveys have identified limited wetland/riparian areas along drainages. The wetland communities identified on the STM site are a very minor component of the total vegetation cover, accounting for less than 1% of the vegetation over an area of less than 0.3 ha (0.75 ac). Riparian shrub communities also occur adjacent to the emergent wetlands.

### Wildlife

A wildlife survey was conducted on the site during 1986 and 1987, and additional surveys were done in 1999 over the Conservation easement property. A new survey to update the data began in 2004 (see section 5.11 for more detail). Mammals seen using the site during the surveys include mule deer, coyote, gray fox, red fox, raccoon, long tailed weasel, striped skunk, spotted skunk, badger, bobcat, mountain lion, rabbits, and yellow-bellied marmots. Seventeen species of birds have been observed on the STM site, along with two species of raptors: kestrels and two nesting pairs of red-tailed hawks. NREL personnel have reported numerous sightings of snakes as well as a golden eagle. A variety of amphibian species are expected to inhabit the area.

### Land Use

The STM site is a 327-acre area predominantly bordered by open grassland zoned for recreation and light-commercial activity. Portions of the community of Pleasant View are located immediately to the south and west of the western portions of the STM site. Pleasant View is currently planning a recreational park immediately south of the STM site. Offices, shops, and a tree nursery owned by the Colorado State Forest Service are located at the far western edge. Undeveloped state land and a Colorado State Highway Patrol pursuit driver-training track are located along the northwestern boundary of the STM site on top of the mesa. Jefferson County open space wraps around the northern and the eastern edge of the site. Portions of the DWOP and apartment homes lie to the east.

More than half of the STM site (177 acres) has been set aside in a Conservation Easement. No development is allowed on that land, with the exception of some existing utility easements and recreational trails to be established by Jefferson County Open Space. Trail development is planned for implementation in phases by the County, and was begun in 2004. (See Section 6.0 for more detail.)

## ***1.2 National Wind Technology Center***

### Geology, Soils, and Hydrogeology

The NWTC site is located on a plain formed by stream deposits. The uppermost geological layer beneath the site is known as the Rocky Flats Alluvium (RFA). It is composed of cobbles, coarse gravel, sand, and gravelly clay. Below the RFA are the Laramie Formation, Fox Hills Sandstone, and Pierre Shale. These rock formations consist primarily of claystones with some siltstones. Unconfined groundwater flow occurs in the RFA toward the east/southeast, and small perched zones are common. Groundwater occurs as confined aquifers in the deeper bedrock formations (EG&G Rocky Flats, Inc., 1992).

The NWTC has a strongly developed soil defined as a very cobbly, sandy loam. The soil is characterized by a large amount of cobble and gravel in the soil volume, and a subsoil dominated by clay (USDA, 1995).

### Surface Water

The area surrounding the NWTC site is drained by five streams: Rock Creek, North Walnut Creek, South Walnut Creek, Woman Creek, and Coal Creek. Rock Creek flows eastward and is located southeast of the NWTC. North Walnut Creek and South Walnut Creek flow eastward into the Great Western Reservoir. Woman Creek drains eastward into Standley Lake. Coal Creek flows in a northeasterly direction across the City of Boulder open space north of the NWTC.

The majority of the NWTC drains into a tributary to Rock Creek. Some of the northern portions of the site drain into Coal Creek or its tributaries.

### Vegetation

The NWTC is located in the transition area between the Great Plains and the Rocky Mountains (Plantae Consulting Services, 2000). This location results in a flora that contains elements from both mountain and prairie ecosystems and associations that represent residual tall grass prairie, short-grass plains, ponderosa pine woodland, and foothill ravine flora (Plantae Consulting Service, 2000).

A vegetation study conducted between August 1999 and August 2000 identified 271 vascular plant species and defined five major habitat types on the NWTC site including the following: seasonal wetlands/or ephemeral hydric soils, woodlands, shrublands, mixed grasslands, and disturbed areas.

Along the Northwestern ridge is a Ponderosa pine woodland area. Vegetation found in this area includes woody species with an understory of grasses, forbs, and shrubs.

### Wildlife

Prior to 1975, livestock heavily grazed the NWTC site, damaging a majority of the native vegetation. A wildlife survey was conducted in 1992 for the entire Rocky Flats Plant and buffer zone area, including the NWTC site. Signs or tracks of bears and mountain lions were identified. Other mammals known to feed at the site are mule deer, coyotes, desert cottontail rabbits, white-tailed jackrabbits, black-tailed jackrabbits, deer mice, prairie voles, and thirteen-lined ground squirrels.

Approximately 20 different species of birds were sighted at or near the site. Raptor (birds of prey) surveys were conducted at the NWTC in 1994 and 1995, and identified seven raptor species on or in the vicinity of the site. An avian survey was also conducted in 2001 to 2002; it is described further in Section 5.10. Although seldom seen, rattlesnakes, bull snakes, racers, and several other reptilian and amphibian species are known to occupy the area.

### Land Use

The NWTC facility occupies a 305-acre area surrounded largely by open space and grazing land. The Rocky Flats Environmental Technology Site borders the NWTC to the southeast, and a sand and gravel mining operation is located along the southern

and western boundaries of the site. A blasting company also has a small installation along the western site boundary.

A piece of land of about 25 acres, located at the southeast corner of the NWTC, was recently designated for inclusion within the NWTC by the National Defense Authorization Act (see Figure 1.3). Two test sites and unimproved roads are located on this land. The transfer of this land parcel from DOE Rocky Flats was completed in 2003.

### ***1.3 Denver West Office Park***

The DWOP is a relatively flat, landscaped office complex occupied by a number of four-story buildings, parking lots, and common areas. NREL-leased facilities at DWOP are located approximately in the geographic center of the development. The DWOP is bordered on the south by commercial areas (West Colfax strip), on the west by the Pleasant View residential area, Camp George West facility, and the STM site. DWOP is within the City of Lakewood.

### ***1.4 Joyce Street Facility***

The JSF is located in a commercial area surrounded by agricultural land, residential neighborhoods, and small businesses. It is currently used by NREL as warehouse space only. No research or support activities are currently conducted at the facility, and there are no staff offices at JSF.

### ***1.5 Renewable Fuels and Lubricants Research Laboratory***

The ReFUEL facility is used for research, testing, and support activities related to advanced fuels, engines, and vehicles to objectively evaluate performance, emissions, and energy efficiency impacts. The laboratory will also be used to evaluate and develop heavy hybrid electric vehicles.

The ReFUEL is a small shop complex housed within the RTD/DSOC facility. The RTD/DSOC facility occupies approximately 22 acres of land, serves as the primary maintenance facility for RTD's bus and light rail train systems. The area around the RTD/DSOC facility consists of commercial and light industrial development.

The site lies on relatively flat terrain with a slight gradient to the northwest. The general area is highly developed with concentrated industrial and commercial activities. Very little natural vegetated habitat exists onsite or in the immediate vicinity. There are trees and shrubs lining the South Platte River adjacent to the site's south, east and northeast.

**Figure 1.5** – STM Site – Aerial view looking west, showing facilities at the western end of the site.



**Figure 1.6** – STM Site – View looking west, showing Camp George West acreage acquired in 1999, a portion of the Pleasant View neighborhood, and the Conservation Easement lands.



**Figure 1.7** – STM Site – View looking northwest at the historic amphitheater and the mesa top facilities. The Colorado State Highway Patrol pursuit driver-training facility is located on the right side of the photo.



**Figure 1.8** – STM Site – View looking northwest, over Interstate 70 at the NREL/DOE buildings in the Denver West Office Park.



**Figure 1.9** – NWTC – View looking northwest



**Figure 1.10** – NWTC – View to the northwest with research facilities shown.



## 2 COMPLIANCE SUMMARY

### *2.1 Laws and Regulations*

#### *Air Quality Protection*

The Colorado Department of Public Health and Environment (CDPHE) administers Clean Air Act implementing regulations for all point sources (facilities or other types of operations) in Colorado, under authority delegated by the U.S. Environmental Protection Agency (EPA). NREL holds two site-wide permits for particulate air emissions from construction and one air emissions permit for a pilot scale research project. Detailed information about NREL's air quality protection program is provided in Section 5.1.

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) requirements specific to radiological emissions from DOE facilities are regulated by the U.S. EPA. NREL's potential emissions are calculated annually using a computer model, and are well below the threshold level. Details are provided in section 5.15.

#### *Drinking Water Quality Protection*

Drinking water quality is regulated for all public water suppliers in Colorado by the CDPHE, under authority delegated by EPA. NREL purchases water that is delivered by truck to the NWTC, and holds a public water supply identification number to provide that water to NWTC site occupants. Detailed information about compliance efforts is provided in Section 5.2.

#### *Ground Water Quality Protection*

Colorado ground water standards are established by the Colorado Department of Natural Resources. That department also issues permits for ground water wells. NREL has no known groundwater contamination and has obtained drilling permits for all of its monitoring wells. Detailed information about NREL's groundwater program is provided in Section 5.3.

#### *Waste Water*

Waste water from the majority of the STM Site and the Denver West Office Park flows into the Pleasant View Water and Sanitation District's (Pleasant View) system, and from there flows to the treatment plant at Metro Wastewater Reclamation District (Metro). Federal and State Clean Water Act implementing wastewater discharge regulations are administered at NREL's STM and DWOP via Pleasant View and Metro requirements. NREL's wastewater discharge policy is in conformance with Metro's discharge requirements. Wastewater at the NWTC site flows into two individual sewage disposal systems (septic and leach fields). These are regulated by CDPHE; inspection and permit issuance have been delegated by CDPHE to the Jefferson County Department of Health and Environment. There is also one individual sewage disposal system at the Solar Radiation Research Laboratory on the mesa top at the STM Site. As is the case with NWTC septic systems, the mesa top

system regulations are administered by Jefferson County. Additional detail about NREL's wastewater discharge program can be found in Section 5.4.

#### *Surface Water Quality Protection*

The authority for implementing storm water discharge regulations at federal sites in Colorado rests with EPA. NREL falls under the EPA Construction General Permit Program for the STM and NWTC sites for storm water discharge from construction areas. Permit coverage for individual NREL activities is obtained when permit thresholds are triggered based on factors such as acreage involved, slope, and soil characteristics. During 2003, no activities requiring permit coverage were conducted. Details of NREL's surface water protection program are provided in Section 5.5.

#### *Waste Management*

The Resource Conservation and Recovery Act (RCRA) established laws that apply to hazardous waste. In Colorado, CDPHE implements hazardous waste regulations under authority delegated by EPA. NREL holds five EPA generator ID numbers for each of its sites. (An additional ID number for the newly-leased ReFUEL Facility was issued by CDPHE in January 2004.) NREL's waste management program is outlined in Section 5.6. Pollution Prevention efforts at NREL are described in Section 5.9.

#### *Storage Tanks*

NREL has no underground storage tanks containing hazardous materials; NREL stores only water in underground tanks at the NWTC. Above ground storage tanks that are larger than 660-gallons are regulated in Colorado by the Colorado Department of Labor, Oil Inspection Section. NREL has two tanks larger than 660 gallons on the STM site that are registered with the Colorado Department of Labor. Details about NREL's tank program are provided in Section 5.7.

#### *Threatened and Endangered Species/Species of Concern*

Wildlife is protected by a number of federal laws, including (but not limited to) the Endangered Species Act, Migratory Bird Treaty Act, and Golden and Bald Eagle Protection Act. The Endangered Species Act also protects threatened and endangered plant species. State laws also designate and protect rare or unique plants and animals. No threatened or endangered species or species of concern have been documented on NREL's sites. Details of NREL's wildlife and vegetation surveys are provided in Section 5.11.

#### *EPCRA Compliance and Prevention of Toxic Releases:*

Executive Order (E.O.) 13148 outlines requirements for SARA Title III, Emergency Reporting and Community Right-to-Know Act (EPCRA) compliance and Toxic Release Inventory reductions for government facilities. NREL maintains hazardous materials permits with West Metro Fire Rescue (West Metro) and provides chemical inventory information to West Metro for the STM site and Building 16 in the DWOP.

In 2003, NREL facilities had no release exceeding the reportable quantity (RQ) of any material reportable under EPCRA. NREL did have quantities of three chemicals on site that exceeded the EPCRA threshold planning quantity for each chemical, so MSDSs and Tier II reports were filed with the state and local emergency planning organizations and with the fire department.

As a research and development laboratory, NREL does not manufacture or process any materials, and during 2003, the Laboratory did not otherwise use any materials on the SARA Section 313 list in quantities exceeding the 4526-kg (10,000 lb) threshold planning quantity. NREL's compliance with EPCRA requirements is detailed in Section 5.8.

NREL maintains an Emergency Management Policy (8-4) and supporting lab-level programs, including an Emergency Response Team Program (8-4.1), for credible on site emergencies. Hazardous material releases are specifically called out as a credible emergency, and response procedures are in place. These procedures are routinely practiced by internal response groups and with external emergency response agencies.

#### *Cultural Resources Protection*

Cultural resources are protected by various laws, including but not limited to, the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act. NREL has two sites listed on the National Register of Historic Places on its STM Site. There are no known eligible sites at the NWTC. NREL's Cultural Resources program is described in Section 5.13.

## **2.2 Executive Orders**

#### *Executive Order 13148*

In March 2000, E.O. 13148, Greening the Government Through Leadership in Environmental Management was issued, requiring that all Federal agencies ensure that environmental accountability is integrated into day-to-day decision making and long-term planning processes. In February 2001, DOE issued a notice (DOE N 450.4) outlining requirements for DOE contractors under Executive Order 13148. NREL's compliance with these requirements is explained below.

Specific requirements under E.O. 13148 require federal facilities to develop and implement environmental management systems, comply with environmental regulations, report as required under EPCRA, reduce the release and use of toxic chemicals, practice pollution prevention, reduce the use of ozone-depleting substances (ODSs) by maximizing the purchase and use of safe alternatives, and implementing sustainable landscaping practices to reduce adverse impacts on the environment.

Details of NREL's Environmental Management System (EMS) and information on the environmental programs that implement the EMS are provided in Section 4.0 and 5.0, respectively. Compliance with environmental regulations at NREL, including EPCRA

is described in Section 2.1, above. ODS and alternative use at NREL are outlined in Section 5.1, and sustainable landscaping is discussed in Section 5.10.

*Executive Order 11988, Floodplains Management:*

According to maps generated by the Jefferson County Department of Highways and Transportation as part of its urban drainage studies, NREL's STM site does not contain any floodplains, and no floodplains have been identified at the NWTC. As a Best Management Practice (BMP), however, all construction activities that may cross a drainage channel are designed to meet the 100-year flood control standards (designed to withstand the equivalent of a 100-year flood).

Actions undertaken by NREL at subcontractor facilities are assessed for potential impacts on floodplains and wetlands at those sites through the use of an environmental checklist.

*Executive Order 11990, Wetlands Protection:*

Limited wetland areas totaling less than 0.3 ha (0.75 ac) occur on the STM site. These are narrow, linear wetlands supporting spikerush, baltic rush, sedges, bluegrass, hemlock, and field mint. These wetlands will be protected from adverse impacts as site development continues.

Wetland areas at the NWTC are extremely limited in extent as well. These areas, along the site's eastern boundary, total less than 0.4 ha (1 ac), and will also be protected from adverse impacts.

### **2.3 Permit Summary**

A table is provided in Appendix A that summarizes NREL's permits, registrations, and notifications.

### 3 ENVIRONMENTAL OCCURRENCES

There were two incidents with environmental implications during 2003 at the STM site, and one at the NWTC.

At the STM site on March 5, 2003, a small fire occurred in a hood in SERF laboratory W214 while researchers were heating a beaker of dimethylsulfoxide (DMSO). When the DMSO reached the appropriate temperature, the hot plate was inadvertently turned to its highest temperature setting instead of “off.” The DMSO boiled over, contacted the hot plate, and ignited. The ensuing fire was immediately extinguished. Damages were minor, the work area was cleaned up, and work resumed. An investigation was conducted into the causes of the incident. Corrective actions to prevent recurrence included changes to procedures for heating the solution, replacing the hot plate, and changes to associated equipment.

At the NWTC on May 2, 2003, Approximately 16-18 gallons of hydraulic oil leaked from a damaged gauge stem onto the floor, apparently passed through cracks in the slab floor, and flowed into a hose trench in the Dynamometer Facility hydraulic room. Absorbent was deployed, and spilled oil was cleaned from the floor and collected from the hose trench. The trench was monitored until oil seepage ceased, with oil being continually cleaned as it seeped into the trench. The investigation revealed that the gauge stem was apparently damaged by a passerby or equipment. Corrective actions to prevent recurrence included eliminating the gauge that failed; procedures to use best practices for guarding, installing, and system monitoring on future installations of gauges or fittings; inspection of all hydraulic installations in NWTC buildings for improper or deficient hydraulic fitting installations and immediate corrective action; and outfitting all hydraulic reservoirs with shut-off valves that can be closed when the systems are not in use.

At the STM site on July 31, 2003, two large propane cylinders were discovered inside a recycling dumpster. Valves had been removed, but one cylinder appeared to be releasing residual gas due to sunlight heating the cylinder. The cylinders were purged with nitrogen to be sure there was no fire or explosion hazard and the cylinders were inert. The cylinders were relocated to NREL’s Waste Handling Facility to arrange for proper disposal. The investigation could not determine how the cylinders got into the metal recycling bin, as it is accessible to all NREL workers. Signage was posted in the area of the roll-off to inform users what materials are and are not acceptable in the metal recycling bin. The information was communicated with staff who routinely use the roll-off, and general information on metal recycling guidelines has been added to the Sustainable NREL Recycling homepage.

## 4 ENVIRONMENTAL MANAGEMENT SYSTEM

### *4.1 Description*

Environmental protection is a priority at NREL, as indicated by NREL's environmental policy:

NREL is committed to sound environmental management that serves as an example to others and supports the Laboratory's mission to protect natural resources through research, development, and deployment of renewable energy and energy efficiency technologies. NREL is committed to:

- Applying sustainability concepts to the design and operation of its campuses and facilities
- Protecting natural and cultural resources
- Incorporating pollution prevention practices in research and support activities
- Improving the effectiveness of NREL's environmental management system (EMS)
- Providing leadership in environmental excellence through consistently high performance and open, responsive communications
- Complying with applicable federal, state, and local environmental requirements and exceeding those requirements, when feasible, by implementing environmental best management practices.

The Environmental Management System (EMS) is in place to implement NREL's environmental policy, and is comprised of a framework of policies and procedures that are integrated with NREL's normal management processes, combined with the environmentally sound daily work practices of Environment, Safety & Security (ES&S) Office staff and staff throughout the Laboratory. Environmental protection must involve everyone at the Lab in order for it to be effective. All activities conducted at NREL must comply with federal and state laws and regulations, and DOE requirements.

As a DOE-owned facility, NREL is required to implement its EMS as part of a Integrated Safety Management (ISM) System, according to DOE direction. The Environmental Management Policy (6-2) and 19 supporting Lab-level environmental programs that define the NREL EMS have been coordinated and linked with the ISM Policy (2-1), the ES&H Policy (6-1), the supporting ES&H Policies (6-3 through 6-6), and approximately 40 supporting Lab-level safety and health programs. The EMS is further integrated with ISM via task specific procedures that flow down from the policies and programs, such as Safe Operating Procedures (SOP).

#### Notable 2003-4 Activities

In the fall of 2003, NREL applied for participation in the EPA National Environmental Performance Track (NEPT) Program and the Colorado Environmental Leadership Program (CELP). NREL was accepted into both programs in early 2004.

An NREL Self-Assessment and DOE-GO Surveillance of NREL's EMS was conducted in 2004. More detail is provided in Section 4.3 of this report.

### ***4.2 Performance Indicators and Progress***

#### 2003 Environmental Objectives and Progress Toward Goals

Each fiscal year, NREL in collaboration with the DOE Golden Field Office (DOE-GO) develop environmental objectives for the upcoming year as part of NREL's One-Year Plan. For fiscal year 2003, the objectives were:

- Complete a self-assessment of the NREL Waste Management Program.
- Complete the STM Site-Wide Environmental Assessment
- Coordinate Sustainable NREL with NREL's EMS
- Pursue an EMS recognition by EPA or other recognized external organization
- Implement improvements identified through assessments and reviews.

The NREL Waste Management Program Self-Assessment/Surveillance was conducted in 2003. Additional information can be found in Section 4.3 below.

The STM Site-wide EA was initiated in May 2002, and was completed in July 2003. It provided a comprehensive review of different development options for NREL's STM Site, analyzing development opportunities by zone on the site. The EA was coordinated with the NREL General Development Planning process that resulted in the Final NREL General Development Vision in November 2003.

Sustainable NREL and EMS staff worked together to compile pollution prevention data on waste generation, recycling, and green purchasing. NREL received a DOE Best-In-Class award for its pollution prevention efforts through Sustainable NREL.

Sustainable NREL and the EMS were further coordinated in 2003 through the application process for acceptance into EPA's NEPT Program and the State of Colorado CELP. NEPT and CELP provide recognition for NREL's EMS, and the performance commitments made through these programs are being implemented at NREL via Sustainable NREL. The commitments made are to reduce overall energy usage, reduce water use, reduce greenhouse gas emissions, and reduce carbon monoxide air emissions. NREL was accepted into the program in early 2004.

#### 2004 Objectives

Environmental objectives developed by NREL in collaboration with DOE-GO for fiscal year 2004 are:

- Continue coordination of Sustainable NREL with NREL's EMS
- Develop scope statements and budget requirements for migratory bird, wildlife, and cultural resource surveys in support of planned development of the STM Site.
- Continue the pursuit of EMS leadership recognition through the EPA NEPA, as initiated in FY03.
- In conjunction with the EPA NEPT, simultaneously pursue EMS leadership recognition through the CDPHE Environmental Leadership Program.
- Implement improvements identified through assessments and reviews.

Progress toward the 2004 goals will be reported in the NREL 2004 Environmental Performance Report.

### ***4.3 Assessment and Improvement***

Periodic assessment and management review of NREL's EMS and its components provide verification that the EMS continues to be an effective tool to: achieve and maintain compliance with regulatory and legal requirements, meet the established environmental goals of the Laboratory, and maintain management support for NREL's environmental goals. Assessment and management review also provide for continuous improvement of the EMS.

There are three different types of assessments performed to evaluate the functionality of the EMS at NREL: EMS assessments, periodic compliance assessments, and third-party audits.

Assessments of NREL's EMS are generally performed internally by a team of NREL staff periodically, but at least every three years. The team generally includes NREL Environment, Safety & Security staff and staff involved in the Sustainable NREL initiative. The scope of the assessments includes both the management of significant environmental aspects and policy implementation. The team evaluates the EMS based on an appropriate set of criteria, such as ISO 14000 standards, EPA National Environmental Performance Track standards, or other applicable environmental management standard. The assessment team selects the most appropriate set of criteria for each assessment.

Periodic compliance assessments are conducted of individual environmental programs to verify that the program, as written, meets all applicable legislative and regulatory requirements and that the program is implemented as intended. Improvements are developed and implemented as necessary, based on the results of each assessment. NREL has established an ES&H self-assessment program to conduct these compliance assessments. These are normally conducted in coordination with the DOE Golden Field Office (DOE-GO) ES&H Surveillance Program. A specific set of Lab-level environment, safety, and health programs are selected for assessment each year based on criteria established by the GO/NREL Operations Team, with the selected set including environmental programs that are part of the EMS.

In addition to regular compliance assessments of individual NREL environmental programs, NREL has management system auditing processes in place for regular reviews and updates of the set of policies, Lab-level programs, and task specific procedures, including EMS policies and programs. NREL reviews its ES&H policies as needed, but at least every 4 years, and makes revisions as necessary. All SOPs are reviewed on an annual basis and are revised as necessary to help ensure the required controls are appropriate for the hazards present. Environmental hazards and controls are specifically called out in each SOP.

Periodically, external third-party assessments may be conducted by technical experts for specific components of NREL's environmental programs or for the EMS as a whole. These assessments are conducted on an as-needed basis. In addition, regulatory agencies may periodically conduct assessments for compliance with environmental programs, at the discretion of the agency.

#### 2003 Assessment Activities

A self-assessment of NREL's EMS was begun in mid-2004. A DOE Golden Field Office surveillance was conducted concurrently. The self-assessment was performed by a team of NREL ES&S staff and staff involved in the Sustainable NREL initiative. DOE-GO staff also participated in the assessment team data collection activities, including interviews. The scope of the assessment included both the management of significant environmental aspects and policy implementation. The team evaluated the EMS using international Global Environmental Management Initiative (GEMI) criteria, which are based on the ISO 14001 standard, and NEPT standard criteria. Self-assessment and Surveillance reports are now being finalized. Results will be discussed in the 2004 Environmental Performance Report.

In 2003, NREL participated in the CDPHE Hazardous Materials and Waste Management Division's (HMWMD) Self-Audit Pilot Study. Concurrently with this activity, NREL completed a self-assessment of the waste management program and the DOE Golden Field Office conducted a surveillance of the program.

The HMWMD intends to develop a compliance assistance program to advise and assist waste generators with the interpretation and application of the Division's regulations. The self-audit pilot study would enable the Division to collect actual compliance/non-compliance activities and provide trending data with which to develop and implement the compliance assistance program, while focusing on those areas that cause the most confusion and non-compliance. Participation in the pilot study was voluntary, and potential candidates were randomly selected from a list of facilities that were scheduled to have an enforcement inspection during the next twelve months. No significant issues or items of non-compliance were identified during the audit, self-assessment, or surveillance.

#### ***4.4 Sustainability and the Environmental Management System***

NREL's mission has always focused on a sustainable energy future for our nation and the world. Sustainability is defined as the simultaneous and balanced pursuit of economic viability, environmental stewardship and public responsibility.

The Sustainable NREL Program was created to realize the vision of greater sustainability in NREL operations. It is an interdisciplinary initiative comprised of staff from numerous NREL centers and offices with the goals of maximizing efficient use of resources; minimizing waste and pollution; and serving as a positive force in economic, environmental, and public responsibility. Elements of the environmental stewardship component of Sustainable NREL include:

- Campus and Transportation
- Water, Electricity, and Natural Gas
- Reduce, Reuse, Recycle, Rebuy
- Education and Communications
- Environmental Management

NREL is committed to, among other things, reducing energy use in its building operations; designing energy efficient and environmentally sensitive new buildings; cutting water consumption; decreasing greenhouse gas emissions; reducing the impact of local NREL travel on the environment; using less fossil-based fuel for local operations; incorporating renewable energy technologies into its on-site STM and NWTC operations; and creating less waste by reducing, reusing and recycling materials for Laboratory operations.

The environmental management component of Sustainable NREL is implemented through the EMS, with the EMS focus on protecting the natural and cultural resources on and around NREL sites and minimizing any potential impacts NREL's activities have on the environment. There is also overlap between the EMS and some of the other components of Sustainable NREL.

More detail is provided elsewhere in this report about the following sustainability-related efforts at NREL:

- Sustainable landscaping is described in Section 3.10, Vegetation Management.
- Pollution Prevention activities are discussed in Section 3.9, Pollution Prevention.

## 5 ENVIRONMENTAL PROGRAMS

The overarching objective of NREL's Environmental Management System and its component programs is responsible stewardship of the environment, both on its DOE-owned sites and leased properties. NREL strives to protect the natural environment by minimizing or eliminating any adverse environmental impacts resulting from NREL activities. The Laboratory's EMS is integrated with other NREL management systems and applies to all research and operations activities. The EMS includes written environmental protection policy and program implementation documents. These are put into practice at all staff and management levels.

NREL's EMS includes components to address waste, air, water, natural resources, and land and soil issues, among others. Descriptions of the components of the EMS are provided in the following sections of this chapter. Sections are organized by resource. Each section is comprised of three areas of discussion: a summary of the environmental management of the resource, a discussion of any relevant permitting, and finally a summary of significant activities that have occurred throughout the year.

A summary of NREL's permits, registrations, and notifications are presented in Appendix A. These permits are discussed in the relevant sections below.

### ***5.1 Air Quality Protection***

#### ***5.1.1 Program Management***

Management in this area is consistent with the following NREL programs: Environmental Permitting and Notification (6-2.1), Air Quality Protection (6-2.5), Ozone-Depleting Substances Management (6-2.6), and Particulate Emissions Control for Construction (6-2.14).

#### ***Criteria, Hazardous, and Non-Criteria Pollutants***

The Clean Air Act and State of Colorado laws and regulations delineate several main categories for air pollutants:

- Criteria air pollutants (e.g. carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter, ozone, and lead)
- Non-criteria pollutants (e.g. ammonia, hydrogen sulfide, pesticides, organic compounds, metallic compounds, and corrosives)
- Hazardous air pollutants (e.g. includes organic compounds, metals, corrosives, asbestos, radionuclides, and pesticides)
- Ozone depleting substances (e.g. chlorofluorocarbons or "freons")

There are notification and permitting thresholds for criteria, hazardous, and non-criteria pollutants. The primary potential sources of these pollutants at NREL include boilers, emergency generators, experimental laboratory hoods,

pilot scale research projects, and small pieces of equipment with gasoline or diesel engines. NREL maintains air emission inventories to track potential air emissions and identify whether notification and permitting could be required for a particular facility or activity. Fugitive particulate emissions from construction activities occurring on NREL's sites are also a potential source.

#### Ozone Depleting Substances

Facilities that service refrigeration equipment containing ozone-depleting substances (ODSs) are required to file an annual notification with the Colorado Department of Public Health and Environment (CDPHE). This equipment servicing must be conducted by EPA-certified technicians, and NREL has certified technicians on staff that perform this type of service.

Another requirement of the State of Colorado's CFC program is that all refrigeration equipment larger than 100 hp that uses ODSs be registered with CDPHE. NREL has a total of three chillers that are registered with CDPHE, two chillers at its Solar Energy Research Facility (SERF) on the STM Site, and one at the DWOP.

Halon-based fire suppression systems previously used at NREL were eliminated by 1999, with all supplies of Halon being transferred to other DOE facilities for "banking".

#### Street Sanding

CDPHE regulations require federal, state, and local government facilities to track wintertime street sanding, and to make efforts to minimize sand use. NREL complies with this requirement and files an annual sanding report with CDPHE. During the period of October 2002 to May 2003 NREL used 31 tons of sand during 13 sanding episodes. During the period of October 2003 to May 2004, NREL used 20 tons of sand during 10 sanding episodes. NREL maintains 4 lane-miles of roads.

#### *5.1.2 Permitting*

Most potential sources of air emissions from NREL laboratory and facility operations in 2003 were small scale and did not require permitting. Permitting thresholds are generally 50, 500, 1000, or 2000 pounds, depending on the pollutant. Projected emissions for these sources were either below thresholds for air permitting or the state reviewed the operation and determined emissions to be negligible in terms of impacts to the environment.

Two site-wide permits for particulate emissions from construction areas have been issued to NREL by CDPHE. One permit covers the STM site, and the other is in effect for the NWTC. Particulate air emissions are controlled by requiring construction subcontractors to follow control measures identified in a

Particulate Emissions Control Plan. NREL also holds one air emissions permit for an experimental pilot process in the FTLB on the STM Site.

### *5.1.3 2003 Activities*

No APENS were filed in 2003.

## **5.2 Drinking Water**

### *5.2.1 Program Management*

Management in this area is consistent with the following NREL Programs: Drinking Water (6-2.3) and Environmental Permitting and Notification (6-2.1).

Drinking water is provided to NREL's STM and DWOP sites by a public water supply, Consolidated Mutual Water Company. Water to the Joyce Street and ReFUEL Facilities is also provided by a public water supply. NREL supplies drinking water to its NWTC by trucking in water from the Boulder public water supply through a subcontracted water hauler. NREL stores the water on site in an underground 15,000-gallon storage tank and an above ground 2000-gallon tank. The 15,000-gallon tank is filled by the water hauler, and water is pumped on demand to the 2000-gallon tank, where it is distributed to the Industrial User Facility (IUF) and Building 251.

Disinfection boosting is performed at the NWTC using a chlorine disinfection system.

Testing for bacteria, lead, and copper is performed at the NWTC according to the requirements of CDPHE. NREL qualifies for reduced lead and copper monitoring. Current state requirements for NREL's site are as follows:

- Bacteria – monthly
- Lead and copper – triennially
- Chlorine residual – monthly, or more frequently as needed

All samples are taken from one of the taps connected to the system. No coliform was detected in any of the samples taken during 2003.

Monitoring for lead and copper was completed as scheduled during the summer of 2002. All samples collected were well below the action levels, and sampling according to NREL's reduced monitoring plan with CDPHE was not to be required again until the summer of 2005. However, the State requested NREL collect lead and copper samples in 2004. All lead and copper levels were below action levels.

Chlorine residual monitoring of the NWTC drinking water system began with the installation of the chlorine disinfection system in 2000. Monitoring is performed to ensure the chlorine residual levels are detectable, with a target concentration of at least 0.2 mg/L of chlorine present to provide sufficient disinfection at the taps for both Building 251 and the IUF. The state requires that chlorine residual monitoring occur when collecting bacterial samples (monthly). NREL monitors chlorine residual levels in the system on a weekly basis and also measures chlorine levels of drinking water that is delivered to the NWTC.

Although potable water delivered to the NWTC is from the Boulder supply that has already been treated and filtered, drinking water at the NWTC is filtered on site using a 1-micron filter. This would filter out any microorganisms (e.g. cryptosporidium or giardia) that are resistant to disinfection. The filters used by NREL are third-party tested to confirm that they actually filter particles as small as 1 micron in size.

If any treatment is performed on supplied drinking water, state regulation requires that a State-licensed operator supervise the treatment. NREL hires a subcontracted operator with a Class A license to supervise the disinfection and filtration operations and to perform the necessary sampling.

#### *5.2.2 Permitting*

NREL has a Public Water Supply Identification Number (PWSID) issued by CDPHE for the drinking water it provides at the NWTC. This identification number does not require periodic renewal, but periodic testing and record keeping is required in connection with the PWSID. No identification is needed for NREL's STM, DWOP, JSF, or ReFUEL sites, as water is piped from a municipal supplier, and NREL does not alter or treat the water in any way.

#### *5.2.3 2003 Activities*

Water sampling in the FTLB, on the STM Site, was initiated in November 2001 in an attempt to isolate the root cause of poor taste with the water supply. Samples were analyzed for total organic carbon, total coliform, nitrate, nitrate + nitrite, sulfate, turbidity, chromium, copper, iron, nickel, lead, zinc, residual free chlorine, and total alkalinity. There were no materials detected in the sampling that would have affected taste; it is hypothesized that reservoir conditions in 2001 could have been responsible for the poor taste. As a result of this sampling, however, lead was detected in two samples. NREL investigated the lead detection in the potable water supply as a separate issue.

In-depth sampling for lead was completed in April and May of 2002, and based on those results, it was determined that lead contamination was not a pervasive problem throughout the FTLB domestic plumbing system. Lead was

not detected in the samples representing water coming into the building through the water main or the service connection that carries water from the water main to the building. Samples representing the plumbing upstream of the individual outlets were non-detectable or very low. In most cases, lead sources appear to be within the outlets or the plumbing leading from the outlets to the lateral piping.

As a result of these findings, AquaPure AP1L3 filters were installed where lead contamination was considered to be a risk for potable water, and sink hardware was changed in several locations. Subsequent monitoring for lead at the FTLB was conducted on a quarterly basis throughout 2003. That sampling verified the effectiveness of the filters and hardware change-outs. In 2004, quarterly sampling was conducted in February and July, with no lead detected above EPA action levels. Therefore the sampling frequency will be decreased to every 6 months for future sampling.

At the end of 2003 chlorine residual testing at the NWTC indicated that chlorine was dissipating too rapidly within the water distribution system. After investigation, NREL determined this was the result of decreased water usage from proactive water saving measures implemented in 2002.

An engineering solution was developed to increase water flow through the piping via a recirculation loop on the system. This involved increasing the amount of chlorine being added to the system, while recirculating water that is in storage in the piping prior to its distribution at potable outlets. This solution was implemented in 2004.

In May 2004, one of the routine bacteriological samples tested positive for coliform. The required follow-up samples were collected and analyzed, with no detection of bacteria.

### ***5.3 Ground Water Protection***

#### ***5.3.1 Program Management***

Management in this area is consistent with NREL's Groundwater Protection Program (6-2.4).

Because of the sensitive nature of the ground water resource, NREL is careful to evaluate all outdoor projects to attempt to eliminate their potential to impact ground water quality. If there are any materials used that could pose a potential ground water risk, the Laboratory typically insists that safeguards to protect ground water be established, such as secondary containment for equipment that could have the potential to leak oil, double wall tanks with leak detection for diesel fuel storage for NREL facilities' emergency generators, and bermed areas to contain experimental materials.

Ground water characterization was begun on the STM site in 1990 with the installation of a monitoring well network. Eight wells were installed at the base of the mesa slope. Four wells were installed upgradient of NREL development in order to provide an indicator that contaminants were not being transported onto the NREL site, and four wells were placed in a generally downgradient direction to verify that NREL activities had not adversely affected ground water quality. Quarterly sampling was performed for five calendar quarters, followed by annual sampling for three years. There was no evidence of contamination found. In addition, routine follow-up sampling was done in 1997. Three of the initial eight wells were closed (according to state requirements) due to construction activities in 1993, and a fourth was found to be inaccessible during the 1997 sampling, presumably also due to construction activity in the area. Therefore follow-up samples were only collected from four of the original monitoring wells: three upgradient wells and one downgradient of NREL development. No evidence of contamination was found in the 1997 sampling.

NREL has not conducted groundwater monitoring at its leased DWOP site, as there have been no activities that pose an unusual risk to groundwater quality. If NREL had reason to suspect a groundwater quality problem, the issue would be addressed with Denver West Management. DWOP management contracted with an engineering firm to conduct a cursory groundwater monitoring study in 1988 adjacent to the NREL-leased buildings. Two monitoring wells were drilled. There were no detections of significant levels of contaminants.

The NWTC currently has no open or active groundwater wells. There was a water supply well that provided water to Building 251 when the site was operated by DOE's Rocky Flats Office. In 1993, NREL collected one round of water samples from this well and the associated water distribution and treatment system for the purpose of determining the most feasible alternative for water supply to the site. Based on the sampling results, it was determined that the maintenance and repairs required to make the existing well and treatment system effective were extensive, and there was an indication of the potential for trace organic compounds in the water. Therefore, when DOE's Golden Field Office assumed landlord responsibility for the site in 1993, the connection between the building and the well was severed. The water supply well was plugged and abandoned in accordance with state regulations by an NREL subcontractor in 1996. Potable water is currently transported to the site, as described in section 5.2. NREL has not done any other groundwater sampling at the site. Groundwater sampling will be conducted if future activities pose a risk to the groundwater quality.

There has been no ground water study performed by NREL at the JSF, as NREL has not conducted any activities at the site that pose an unusual risk to ground water. All activities at the site are conducted inside the facility with the

exception of routine deliveries and pick-up of inventory stored in the warehouse.

There is currently no ongoing routine ground water monitoring program on any NREL site, because, with one exception, there have been no activities identified that currently or historically posed a significant risk to ground water. The one occurrence that had the potential to impact ground water was a diesel leak to the environment in June 1998 from a failed check valve on the PDU emergency generator above ground storage tank at the Alternative Fuels User Facility. The majority of contaminated soil was excavated and removed from the site for disposal at a permitted landfill. Three ground water monitoring wells were installed at the site in September 1998, one upgradient, and two downgradient. No hydrocarbon contamination was detected in the ground water during the initial sampling of the three wells, nor during follow-up sampling conducted in March and September 1999, and March 2000. Based on the results of these follow-up samples no further samples will be collected.

#### *5.3.2 Permitting*

All ground water monitoring wells installed by NREL at the STM site have been permitted with the Colorado Department of Natural Resources. Abandonment paperwork has also been filed with the State of Colorado for the three wells that were plugged in 1993.

#### *5.3.3 2003 Activities*

Plans are being developed to close the three monitoring wells installed in September 1998.

### ***5.4 Wastewater Discharge***

#### *5.4.1 Program Management*

Management in this area is consistent with NREL's Waste Management and Minimization Program (6-2.8).

The majority of wastewater from NREL's STM and DWOP facilities flows into the Pleasant View Water and Sanitation District's system and ultimately to Metro Wastewater Reclamation District's (Metro) treatment plant. There is a small septic system consisting of a tank and absorption field, on the mesa top serving the Solar Radiation Research Laboratory (SRRL), because there is no sewer line to the mesa top. Wastewater from the JSF and the ReFUEL Facility also flows to Metro's treatment plant. The NWTC is not connected to a sewer system, but has two septic systems that include tanks and absorption fields for the treatment of wastewater.

It is NREL policy that hazardous chemicals are not to be discharged to the sewer system, and NREL staff are trained in this policy. In addition, NREL sites have design criteria for waste drains in lab areas to minimize the possibility of a hazardous material discharge. These criteria include measures such as secondary containment for any chemicals used near sinks in laboratory exhaust hoods, no floor drains in laboratory areas unless a specific need can be shown, and caps for any floor drains that are installed in lab areas. New research and operations activities as well as ongoing activities that undergo significant modifications are reviewed for their potential effect on wastewater character through NREL's risk assessment process.

#### *5.4.2 Permitting*

No permitting for the majority of NREL's wastewater discharges is required. NREL has no direct wastewater discharges to the environment at the DWOP or JSF, so no National Permit Discharge Elimination System (NPDES) permitting is necessary. NREL maintains three individual sewage disposal systems, two at the NWTC and one at the STM site. The remainder of NREL facility wastewater is discharged to Metro through the sanitary sewer system. NREL facilities are currently classified by Metro as non-industrial water users at these sites. As non-industrial users, NREL sites do not need a permit from Metro for sewer discharge, and monitoring for pollutants in wastewater is not required.

NREL maintains septic permits from Jefferson County (an authority delegated to the counties under a State of Colorado program) for the NWTC IUF septic system as well as for the SRRL facility on the STM site mesa top.

#### *5.4.3 2003 Activities*

There were no new significant activities during 2003 in this area.

### ***5.5 Surface Water Protection (Storm Water)***

#### *5.5.1 Program Management*

Management in this area is consistent with the following NREL Programs: Storm Water Pollution Prevention for Construction Activities at the STM, and Storm Water Pollution Prevention for Construction Activities at the NWTC (6-2.15 and 6-2.16, respectively)

Limited storm water monitoring was conducted at the STM site during the summers of 1992 and 1993 to characterize surface water quality at NREL's existing level of activity at that time, and to confirm that NREL's activities were not adversely impacting storm water quality on the STM site. Sampling indicated that NREL's activities are not resulting in contamination of storm water runoff.

No storm water monitoring has been conducted at NREL's other sites. In 1998, surface water samples were taken in two drainages at the NWTC in connection with NREL's weed control efforts. No traces of the herbicide applied to weed-infested areas were detected in the water samples.

Outdoor research projects are reviewed during the planning stages, through NREL's NEPA and risk assessment processes, for potential impacts to surface water. Measures to prevent such impacts are incorporated, as appropriate, into the design for each project. Such control measures could include secondary containment and bermed areas where chemicals will be used, or installation of a cover or roof to protect chemical use and storage areas from precipitation and adverse weather conditions.

Storm Water Pollution Prevention Plans (SPPP) have been written for construction activities on both the STM and NWTC (6-2.15 and 6-2.16, respectively). Erosion and sediment controls are implemented according to the plans, and periodic site inspections are conducted to verify that the controls are functioning properly and to identify any repairs to the erosion and sediment controls that are needed. Written reports are issued for each inspection, with corrective actions assigned to responsible staff when necessary. The SPPPs also provide for prompt revegetation of disturbed areas. Provisions of the SPPPs are implemented through coordination with NREL's construction subcontractors.

#### *5.5.2 Permitting*

NPDES notification for storm water discharges on federal facilities in Colorado is under the jurisdiction of the Environmental Protection Agency (EPA). NREL is currently covered under EPA's general permit for storm water discharge associated with construction activities on the STM and NWTC sites. Both Midwest Research Institute, as operator, and DOE, as site owner, have filed Notices of Intent for appropriate construction activities on the STM and NWTC Sites. No permits are required for NREL's routine operations.

#### *5.5.3 2003 Activities*

In 2003 there were a few research-related and paving construction projects for which erosion and sediment control programs were developed. These were minor in terms of the extent of soil disturbance. The only major project during 2003 was the construction of a natural gas pipeline at the NWTC. The project began in late 2003 and was completed in early 2004. Reseeding was completed, and revegetation is considered complete as of September 2004. A Notice of Termination on the project will be filed with EPA in the Fall of 2004.

## **5.6 Waste Management**

### **5.6.1 Program Management**

Management in this area is consistent with the following NREL Programs: Waste Management and Minimization (6-2.8), and Environmental Permitting and Notification (6-2.1).

Hazardous wastes are handled and disposed according to the Resource Conservation and Recovery Act (RCRA). NREL facilities' waste profile consists of a broad range of hazardous laboratory chemicals in small quantities. Chemicals in solid or liquid form are collected in each laboratory or at each experimental site. These wastes are periodically collected from the laboratories and prepared by the NREL ES&S Office for off-site disposal.

Treatment and disposal is conducted at EPA-permitted treatment, storage, and disposal facilities. In addition, NREL facilities have adopted a conservative waste disposal policy in which materials that are not regulated by RCRA, yet pose a potential hazard, are collected and disposed of as non-hazardous material at a RCRA-permitted disposal facility.

NREL facilities also generate low-level radioactive wastes. This waste normally consists of personal protective equipment, disposable labware, scintillation fluids, and water-based liquids. Radioactive waste is shipped off-site for disposal on an as-needed basis.

### **5.6.2 Permitting**

NREL has four separate sites that have the potential to produce limited quantities of hazardous materials. Each of the four sites has a Resource Conservation and Recovery Act (RCRA) waste generator identification number issued by the State of Colorado. The South Table Mountain and Denver West Office Park locations are classified as "small quantity generators," generating less than 1000 kg of waste per month. The other two sites, the Joyce Street Facility and the National Wind Technology Center, are classified as "conditionally exempt small quantity generators," generating less than 100 kg of waste per month.

### **5.6.3 2003 Activities**

In calendar year 2003 NREL shipped 20,638 pounds (9,381 kg) of hazardous waste, and 5,232 pounds (2,378 kg) of non-RCRA regulated waste for disposal. These quantities are approximations only. The materials are normally not weighed when picked up by disposal or recycling vendors. Typically, a vendor will provide its good faith estimate of quantity based on practical experience.

The quantity of low level radioactive waste shipped for off-site disposal in 2003 was 715 pounds (325 kg), which included 209.46 MBq (5.655 mCi) of carbon-14 and tritium. Information regarding the types and quantities of radioactive materials used at NREL facilities is detailed in Section 5.15.

Data entered into the DOE Pollution Prevention database, which represent waste generated on a fiscal year (October 1 through September 29) basis are as follows for fiscal year 2003: 21,725 lbs of hazardous waste, 5469 lbs of non-RCRA regulated waste, 21.9 cu ft low level liquid radioactive waste, and 14.6 cu ft. low level solid radioactive waste.

In 2003, NREL participated in the DOE Materials Exchange program by sharing the list of chemicals available for redistribution with other DOE facilities. This effort may contribute to waste reduction within the DOE organization.

An assessment of the Waste Management and Minimization Program was conducted by both NREL and the Colorado Department of Public Health & Environment in 2003. Details are discussed in Section 4.3.

## ***5.7 Storage Tanks (Underground and Above Ground)***

### ***5.7.1 Program Management***

Management in this area is consistent with the following NREL programs: Aboveground Storage Tank Management (6-2.7) and Spill Prevention Control and Countermeasures (6-2.10)

NREL facilities store diesel for emergency generator and research use in aboveground storage tanks. The NREL tank inventory is presented in Appendix B. NREL's tank management program focuses on proper tank design, operation, and inspection to protect against spills and leaks. The program is designed to meet regulatory requirements, and it is more stringent than the regulations require in many areas.

Several important safeguards have been incorporated into NREL's tank management program to prevent any accidental releases of diesel fuel from the storage tanks. These safeguards include both mechanical safeguards, such as double wall tanks with sensors that result in an alarm if the inner tank wall is leaking, overfill prevention, and spill protection; and procedural safeguards such as written operating procedures and tank filling procedures. All tanks larger than 110 gallons are visually inspected at least once per month.

Due to the quantity of diesel fuel stored on the STM site, a Spill Prevention Control and Countermeasures Plan is required to be in place. This Plan

describes the site topography and neighboring areas, and outlines the steps necessary to mitigate any spills or leaks of diesel fuel. To date, NREL has not had any offsite impacts related to tank activities.

#### *5.7.2 Permitting*

Tanks larger than 660 gallons are required to be registered with the State of Colorado, with the registration renewed annually. Currently, only two tanks meet the registration threshold, the SERF emergency generator diesel storage tank and the Process Demonstration Unit (PDU) ethanol storage tank at the Alternative Fuels User Facility (AFUF), both located on the STM site.

#### *5.7.3 2003 Activities*

There were no spills or leaks from NREL tanks during 2003. There was no state inspection in 2003.

### **5.8 Hazardous Materials Management**

#### *5.8.1 Program Management*

Management in this area is consistent with the following NREL programs: Chemical Safety Program (6-4.6), and Asbestos Management Program (6-4.18)

No hazardous waste sites have been identified on any of the Laboratory sites. Therefore, many sections of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) do not apply to NREL facilities.

NREL facilities are subject to the emergency reporting requirements in Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-To-Know Act (EPCRA). Section 302 of these regulations requires a facility to notify the State Emergency Response Commission (SERC) that it is subject to emergency planning and notification requirements if any chemicals in the facility's inventory are stored in quantities greater than prescribed threshold planning quantities (TPQs). NREL facilities first became subject to planning and notification requirements in 1988.

EPCRA Section 304 requires facilities to immediately notify the Local Emergency Planning Committee (LEPC) if there is an accidental spill or release of more than the predetermined reportable quantity (RQ).

According to Section 311 and 312 of EPCRA, NREL provides Material Safety Data Sheets (MSDSs) for chemicals that are stored on-site in quantities greater than TPQs, and provides inventory reporting for these same chemicals in the form of Tier I or Tier II reports to emergency planning and response groups.

NREL provides additional emergency response and reporting information to the Jefferson County Emergency LEPC, the SERC, and West Metro Fire Protection District when requested. The Jefferson County LEPC uses Uniform Fire Code hazard categories and threshold reporting quantities rather than those specified in SARA Title III, resulting in a larger number of individual hazard categories and lower reporting thresholds. NREL has an active involvement in the emergency planning concepts of SARA Title III, in that the Laboratory currently has two acting members on the Jefferson County LEPC, and has been represented since the LEPC's inception.

The Laboratory is also subject to reporting requirements in the event of a release of an RQ of any hazardous substance listed by EPCRA. EPCRA Section 313 requires that a toxic chemical release inventory report (Form R) be filed with EPA for any chemical that is manufactured, processed, or otherwise used in quantities exceeding Threshold Planning Quantities (TPQs). Although NREL is not a manufacturing facility and does not fall within any of the Standard Industrial Classification (SIC) codes for which Section 313 reporting is required, Executive Order 12856 requires all federal facilities to file a report, if applicable, regardless of SIC code.

Section 112r of the Clean Air Act regulates numerous toxic and flammable substances, and threshold quantities are established under Section 112r of the Clean Air Act. All thresholds are 500, 100, 2500, 500, 10,000, 15,000, or 20,000 pounds, depending on the material. The threshold quantity applies to the quantity of substance in a single process, not at the facility as a whole.

NREL has a Laboratory-wide chemical management system that serves as a centralized chemical inventory as well as a tool for managing and reporting on chemicals used at the Laboratory. Using an electronic barcoding system, the CMS tracks chemicals from the point of receipt through disposal. The system also contains technical data and reporting information for many of the chemicals in the CMS database. Key functions of the system include:

- Providing current inventories by room, building, and/or site
- Improving research efficiency and minimizing hazardous waste generation by allowing staff to determine if needed chemicals are already available on site prior to making chemical purchases
- Providing quick access to chemical inventories and hazard information during emergency responses
- Facilitating accurate and efficient reporting to external agencies (e.g. fire districts, EPC, EPA, DOE)

To maintain the CMS database, a physical inventory of each lab and work area in which chemicals are used or stored is conducted periodically.

NREL has not identified any areas within its facilities that contain residual contamination requiring special decommissioning. Asbestos surveys have been conducted in a number of NREL facilities: Joyce Street Facility; Building 251 at the NWTC; Building 16, and at the STM Site the AFUF (only older areas of the building), FTLB and SRRL. No asbestos was found at the Joyce Street Facility and the AFUF. The other facilities have limited amounts of asbestos-containing material in areas such as floor tile, lab countertops, caulking and sealants, and roofing material. Asbestos-containing materials are left undisturbed whenever possible. If renovation is planned that will disturb asbestos-containing material, then certified asbestos removal contractors are used and strict asbestos removal procedures are followed. An Asbestos Management Program is in effect for all NREL facilities.

#### *5.8.2 Permitting*

NREL obtains annual Hazardous Material Permits from West Metro for the STM and DWOP sites. The permits are required by the West Metro and are issued by building. NREL obtains permits for a total of six buildings where hazardous materials are stored and/or used. Prior to issuing the permits, a representative from West Metro conducts a walk-through inspection of the entire South Table Mountain Site and DWOP.

#### *5.8.3 2003 Activities*

In 2003, the U.S. EPA conducted soil sampling at NREL's NWTC Site. Sampling results were compared to standard criteria by EPA. Based on the results, EPA issued a letter clarifying that NWTC is not on the CERCLA list of potential Superfund Sites.

West Metro conducted a walk-through inspection of NREL's STM and DWOP facilities in the spring of 2003. Annual hazardous materials permits for the six buildings were issued following the inspection. West Metro provided a few recommendations as a result of that inspection. Recommendations included: labeling natural gas lines in four labs at the AFUF, installing hazard placards on doors in four labs at the FTLB, installing a hazard placard on the south side of the Waste Handling Facility, replacing warning signs at the SERF loading dock area that had faded, and placing 55-gallon drums in secondary containment. All recommendations have been implemented with the exception of the last, which is still being discussed with West Metro.

The CMS was used to provide complete chemical inventories for each facility to West Metro when applying for Hazardous Materials Permits in 2003. The CMS was also used to post individual laboratory chemical inventories on the ES&H website, which were updated monthly.

In 2003, NREL had three chemicals on-site in quantities that exceeded the TPQs, sulfuric acid, hydrofluoric acid, and hydrogen selenide. The proper MSDSs and Tier II forms were submitted to state and local emergency response organizations and the local fire department.

In 2003, NREL facilities had no release exceeding the RQ of any reportable material under EPCRA.

As a research and development Laboratory, NREL does not manufacture or process any materials, and during 2003, the Laboratory did not use any materials on the Section 313 list in quantities exceeding the 4536-kg (10,000-lb) threshold planning quantity.

## ***5.9 Pollution Prevention & Sustainability***

### ***5.9.1 Waste Minimization, Recycling, and Green Purchasing (Purchasing Materials With Recovered Content)***

As a facility that focuses on the research, development, and deployment of renewable energy and energy efficiency technologies, NREL is committed to responsible environmental stewardship. A significant part of this effort is pollution prevention. NREL's Waste Management and Minimization Program outlines pollution prevention principles that are consistent with the EPA's hierarchy of preventing or reducing pollution at the source; recycling or reusing waste materials that cannot be prevented; and environmentally safe treatment and disposal of waste that cannot be prevented, recycled, or reused.

The current pollution prevention program includes training on waste handling, waste minimization, and methods to eliminate releases to air, soil, or wastewater. In addition, the ES&S Office integrates pollution prevention awareness into NREL activities in a number of ways. The proposed use of chemicals in projects are evaluated prior to use during project planning reviews, Safe Operating Procedure reviews, and Readiness Verifications conducted according to NREL's Hazard Identification and Control Program (ESH 6-6.2). During these reviews, NREL staff evaluates opportunities for chemical substitution as well as methods of reducing the volume of chemicals used and waste streams generated.

The use of bankcards for chemical purchases has been another means of reducing the volume of chemicals purchased, stored and disposed at NREL. Under the bankcard chemical purchasing system, a small group of chemical users are given privileges to order chemicals directly from the vendor using their bankcards. Because bankcard purchasing expedites chemical purchases over conventional purchasing processes at NREL, users order only the chemicals they foresee they'll need in the immediate future, knowing that they

can quickly obtain more if needed. The ES&S Office reviews all chemical purchases made using the bankcards.

Recycling and reuse activities are important components of NREL's pollution prevention program. NREL's recycling program is managed by a crosscutting committee comprised of staff from around the Laboratory, and led by Sustainable NREL. Items currently recycled or reused at NREL include the following:

- fluorescent bulbs
- batteries
- styrofoam peanuts and other packing materials
- freon from refrigerator units
- scrap metal
- wooden pallets
- laser printer cartridges
- aluminum and tin cans
- glass
- plastics (1 & 2 only)
- newspaper
- white and mixed paper
- corrugated cardboard
- boxboard
- books and magazines
- transparencies, and
- tyvek envelopes

Several central recycling locations are available for most recycling needs throughout NREL facilities. NREL also offers a chemical redistribution program where chemicals in original containers are made available to staff at NREL and other DOE facilities to be reissued for research activities at no cost. The NREL CMS is used for redistributing chemicals to new users.

In 2003, NREL generated 218 metric tons of solid waste and diverted 72 metric tons to recycling, or 33% of the total. Data for some of the materials recycled by NREL during 2003 follow. The data below are the quantities entered into the DOE Pollution Prevention database, which tracks recycling on a fiscal year (October 1 through Sept. 29) basis. Data are for fiscal year 2003. Quantities are not tracked for all materials that are recycled, so the list below does not include all recycled materials.

Batteries	2,590 lb
Fluorescent bulbs	203 lbs
Mixed metal	56,720 lb
Commingled containers	25,646 lb

Cardboard	24,300 lb
Misc. paper	175,677 lb
Computer monitors	3,219 lbs

NREL also performed an analysis of its solid waste stream to determine the recyclable content. It was determined that some 30% of the waste stream was recyclable material. This analysis serves as the basis for defining the focus of recycling activity for FY2004 and beyond.

When possible, NREL purchases products with recovered content. In 2003, some of the products purchased containing recovered content included carpeting, uncoated-printing paper, and toner cartridges. One hundred percent (100%) of NREL's supply of carpet, uncoated printing and writing paper, and toner cartridges purchased in 2003 contained recovered content.

### 5.9.2 Vehicles

NREL leases 47 vehicles from the General Services Administration. These vehicles are used for a variety of transportation and special purpose activities, such as equipment moving and servicing, grounds maintenance, and travel between the NREL sites. Of those vehicles, 29 are alternative fueled vehicles or hybrid vehicles. It is NREL policy to replace standard vehicles with alternative fuel vehicles whenever a suitable vehicle is available from GSA, with an ultimate NREL goal of 100% AFVs and hybrids. In fiscal year 2003, NREL was able to reduce its petroleum usage by 30% over the base year, 1999. The goal set by E.O. 13149 for all federal agencies is to reach a 20% petroleum use reduction by 2005.

### 5.9.3 Energy

NREL has already met the 2005 and 2010 Federal requirements for reduction in energy use per square foot in laboratory and industrial facilities using a DOE 1990 baseline. The baseline is the average for all DOE Laboratory and Industrial Facilities in 1990. For NREL, this baseline is 352,540 BTU/SF and will be applicable to NREL facilities from 2002 forward.

Table 5.1 includes the FY 1990 baseline and summarizes the energy consumption per gross square foot for Total NREL facilities, which includes both the South Table Mountain and National Wind Technology Center sites.

Table 5.1 – Energy Consumption

	BTU/GSF
FY1990 BASE YEAR	352,540
FY2001 TOTAL NREL (DOE-owned)	271,247
FY2002 TOTAL NREL (DOE-owned)	270,495
FY2003 TOTAL NREL (DOE-owned)	257,887
FY2003 TOTAL NREL (w/ Wind Source Credit)	240,525

Comparing total NREL energy consumption in FY 2003 to the baseline, the energy consumption is 27% lower than the FY 1990 baseline. In addition, the total NREL energy consumption with wind source Credit is 32% lower than the FY 1990 baseline.

*Individual Building Metering & Individual Energy Saving Program.* NREL previously received gas and electrical utility billing from the utility company, Xcel, on a monthly basis for NREL's two sites. The electrical utility billing was not broken down into individual buildings within each site; Xcel only provided the total electrical power consumption and billing data for the entire site. In 2002, NREL completed installation of individual power meters at each major facility on the STM and NWTC sites. Individual metering will allow better understanding of energy use and identify further opportunities for energy use and peak demand reductions.

In 2003, NREL's efforts were focused on organizing the metering data and making it accessible to NREL management, building managers, and building occupants as a method of providing feedback on building energy use. As a result of these efforts, all individual building metering information is on an energy performance data website on the NREL intranet. The website contains information about current and historical energy use patterns. A program to educate building occupants on energy saving opportunities is also being implemented. The objective of providing feedback and education on energy saving opportunities is to reduce energy use at the individual level.

In addition to improving the organization and accessibility of energy use data, in 2003 NREL also installed an energy analysis software package that is used to identify opportunities to reduce peak power demand using the site metering data. A more robust demand management program will be implemented using this analysis software and site metering data to secure additional peak demand savings.

*Building Energy Retrofits.* In 2003, two upgrades to existing building systems were made to improve energy efficiency and reduce energy use: SERF exhaust fan upgrades and installation of a SERF processed water heat exchanger.

Prior to the upgrade, SERF exhaust systems in the west and center wings introduced dilution air into its exhaust system to maintain duct static. With the installation of variable speed drives on the exhaust fans in the west and center wings, the dilution air was reduced and allowed the fan to operate at a lower speed, which reduced energy consumption.

The SERF process cooling load is fed by the chilled water plant. Adding a heat exchanger between the process cooling load and the heat recovery system

provides free cooling which will minimize the usage of the chilled water from the chiller and reduce energy consumption by 20,000 therms/year.

*Energy Efficiency Specifications for Renovations/New Construction.* NREL has always emphasized significantly greater levels of energy efficiency than federal standards with all of its DOE-owned buildings, with a goal to reduce energy use by 30% compared to the federal standard reference for building systems at 10 CFR 434. Energy efficiency criteria have been incorporated into the established NREL design standards and specifications for all construction projects. All new buildings must meet, at a minimum, Leadership in Energy and Environmental Design (LEED) Silver criteria, established by the U.S. Green Building Council. In addition, all new laboratory buildings are designed according to the principles of the Laboratories for the 21<sup>st</sup> Century Program. See the "Sustainable Building Design" section below for more detailed information.

*Computer/Monitors Purchasing.* NREL Information Services (IS) provides a standard hardware list of recommended Energy Star products for PC and MAC computers, monitors and peripherals. Staff is encouraged to purchase Energy Star hardware items through the "Basic Ordering Agreement" (BOA) contracts. Suppliers websites provide energy information for standard products. Flat panel monitors, that use significantly less energy than standard monitors, have been added to NREL's standard supply list and are the priority purchase recommendation.

*Computer Power Management.* A computer power management project, begun in 2001, made significant progress toward full implementation in 2003. The project involved piloting computer power management software to centrally control implementation of aggressive suites of power management settings and automatically shut down computers at prescribed times at the end of workdays and on weekends. Baseline data collection using this tool was completed. Implementation of the tool on a Laboratory-wide basis is in progress and will be completed in FY2004 and FY2005. NREL has also developed a web-interface so that computer power management data for individual computer, organizational, and Lab-wide use is available.

*Printers and Copiers.* Networked printers are configured automatically to enter a low-power mode of 15-45 watts or less after a period of inactivity (this time period differs with models). Seventy-one duplex modules were purchased in FY 2001 and installed on network printers configured to default duplexing. Users can control one-sided printing through the applications print feature. All copiers are Energy Star rated.

#### 5.9.4 Renewable Energy

*Self-generated electricity.* In 2003, NREL generated about 61,290 kWh of

electricity from grid-connected PV panels each year. These panels are located on the Solar Energy Research Facility, the Site Entrance Building, and the Outdoor Test Facility.

The NREL NWTC has approximately 1600 kW of installed wind turbine capacity used for research purposes. When the turbines are running, the energy that they produce is used to offset simultaneous NWTC site energy use. In 2003, actual energy produced by the NWTC wind turbines was 59,750 KWH.

*Purchased renewable energy.* In FY2003, NREL purchased 1,981,200 kWh of wind-generated electricity from the local utility company, Xcel Energy. This purchase represents about 10% of NREL's annual electrical usage. NREL has committed to purchase another 1,981,200 kWh of wind-generated electricity for FY2004 and will be negotiating agreements for FY2005 and beyond.

#### 5.9.5 Water Conservation

In 2002, NREL completed a Water Efficiency Plan that also identifies and ranks available water savings best management practices (BMPs) in accordance with the Federal Energy Management Program (FEMP) guidelines. In fiscal year 2002, one BMP was implemented: NREL installed low-flow toilets, waterless urinals, and low-flow showerheads in 100% of existing facilities. In fiscal year 2003, NREL implemented the Public Information and Education Programs and Water Efficient Landscaping BMPs at 100% of DOE-owned buildings.

Water use data for the STM site is obtained from the water supply company, Consolidated Mutual Water. All of the facilities that require water on the STM site have dedicated water meters. There are also water sub-meters on all three cooling towers at the STM site.

The NWTC site is a remote site that has no wells or water supply. Boulder Public Water Supply water is delivered weekly to the NWTC, as described in Section 5.2. Currently water usage at the NWTC is measured by the amount of water delivered to the site.

The water use for all NREL sites is summarized in Table 5.2. Water consumption was 24% lower in FY2003 as compared to FY2000 base year.

Table 5.2 – Water Consumption

	Million Gallons per Year (MGY)
FY2000 (BASE YEAR – TOTAL NREL)	12.9
FY2002 – TOTAL NREL	10.9
FY2003 – TOTAL NREL	9.8

#### *5.9.6 Sustainable Building Design*

Several of NREL's buildings, including the Thermal Test Facility (TTF) and Solar Energy Research Facility (SERF) are models of energy efficiency. The SERF's annual energy costs are 40 percent below that of a similar building designed to meet federal energy standards, and the TTF operates on 63 percent less energy than a building designed to meet the Federal Energy Code. The TTF building received a 2002 Federal Energy Saver Showcase Award.

The proposed Science and Technology Facility (S&TF), slated for construction in early 2005, has been designed to be at the LEED Gold Level. Its projected energy cost reduction is 50% better than the requirement for federal facilities (10 CFR 434). The S&TF is a Laboratories of the 21<sup>st</sup> Century Pilot Partner Project.

The NWTC Site Entrance Building (SEB) was designed in-house by NREL staff during fiscal year 2002. Construction was completed in early 2003. The building was designed to be a near zero energy building; its systems are fully monitored. The NWTC SEB is 16'x 10', and uses NREL technologies to reduce the power demand of the building. Such technologies include daylighting, passive solar heating, good thermal envelope, natural ventilation through the windows, low-e windows, overhangs for shade control, a Trombe wall, occupancy and daylight sensors, high-efficiency lighting with dimming fixtures, and the use of energy efficient flat screen computer monitors. These technologies, along with a roof mounted 768 W photovoltaic array, and two 1000 W wind turbines, reduce the amount of electricity drawn from the utility grid and feed excess electricity produced back to the grid.

#### *5.9.7 Technical Assistance and Outreach*

*Outreach by Leadership.* In 2003, NREL staff developed a Sustainable Design Guide for Los Alamos National Laboratory. NREL FEMP staff have assisted in developing both Energy Management and Water Management Plans at NREL. In addition, NREL FEMP staff developed the Department of Commerce agency-wide energy plan and are in the process of assisting several other agencies in their energy planning processes. NREL researchers work with DOE, EPA, the US Green Building Council, and others on a variety of assistance and outreach programs and activities related to energy and water use. Examples include standards development, conferences, classes and workshops, tours, publications, websites, and energy and water analysis software. NREL's activities in this regard can be surveyed through the most recent Institutional Plan or Performance Assessments, accessible on NREL's website ([www.nrel.gov](http://www.nrel.gov)).

*Outreach by Recognition.* In 2003, as a component of its outreach efforts to disseminate information regarding sustainability, NREL applied for and

received a number of awards. The awards were: CU Wirth Chair Award in Environmental and Community Development Policy, DOE Departmental Energy Management Achievement Award: Effective Program Implementation – Sustainable NREL, and DOE Best-In-Class Pollution Prevention Awards. The latter award was specifically for Sustainable NREL's New Buildings Program; Recycling Program; and Education, Outreach, and Information Sharing Program.

*Internal and External Outreach.* NREL has produced a number of publications with the goal of sharing the details of NREL's Sustainability Program with staff and the public. These include the Sustainable NREL Pioneer, an internal electronic publication; an NREL Sustainability Report, that will be distributed, in FY2004 and FY2005, both internally to NREL staff and to the public; and a Life Cycle Assessment paper that estimates NREL's carbon dioxide (CO<sub>2</sub>) footprint. Also as part of Sustainable NREL's internal outreach program, in 2004, the Laboratory began implementation of a webpage with an enhanced suite of sustainability tools for employees, for example, tools that address alternative commuting, computer power management, and CO<sub>2</sub> emissions equivalents from employee activities and laboratory operations.

## **5.10 Vegetation**

### **5.10.1 Program Management**

Management in this area is consistent with NREL's Weed Management Programs for the STM and NWTC (6-2.12 and 6-2.13, respectively) and the Sustainable Landscape Design and Management Program (6-2.19).

NREL's basic philosophy regarding vegetation is to conserve the ecosystems on the site in their natural state as much as possible. There is some landscaping using non-native drought-tolerant species adjacent to some of the buildings, and even a few areas at the STM site of bluegrass. However the native vegetation and natural character of the landscape is maintained over the majority of the site. Revegetation of areas to be left in their natural state following disturbance from construction or other outdoor activities is conducted using a native seed mix of grasses and forbs. This mix is site-specific and is comprised predominantly of natives that were originally present on the site before disturbance. That seed mix and revegetation procedures are outlined in NREL's Storm Water Pollution Prevention Programs for the STM and NWTC Sites. The use of native species is required at both the STM and NWTC whenever feasible. When possible, replacement of high water demand species, like Kentucky bluegrass, with drought-tolerant species is encouraged.

A vegetation survey of the STM site was conducted in support of the 1993 site wide Environmental Assessment, and a site reconnaissance was performed by Dames & Moore biologists in November 1997 (U.S. DOE, 1998, page 3-1).

In 1999, a verification survey of STM site vegetation was performed on the Conservation easement property to identify any changes to habitat character or species types that may have occurred since the 1993 and 1997 surveys. An effort was made to determine whether any sensitive species or habitats that could potentially support such species were present on the site. No sensitive species or potential habitats were identified on the STM site.

A vegetation survey of the STM was conducted between June 2001 and May 2002. Five general habitats were described on the STM site, comprising seven plant communities (Plantae Consulting Services, 2002). No rare or imperiled plant species were found on the site. Areas of mixed foothills shrublands (also called tall upland shrubland) were identified on top of the mesa within the Conservation Easement area. This natural community is listed as rare and imperiled by the Colorado Natural Heritage program. No development will occur in the Conservation Easement area.

Eleven noxious weed species were located on the STM site. Four of these belong to Colorado's top ten prioritized-for-control weed species. These four include Canada thistle, diffuse knapweed, field bindweed, and musk thistle.

A three-season vegetation survey of the NWTC site was performed between August 1999 and August 2000. The survey defined five general habitats on the NWTC site, comprising nine plant communities and 271 vascular plant species (Plantae Consulting Services, 2000). No rare or imperiled plant species were found on the site. However, the survey identified a small area of xeric tallgrass prairie (defined as mesic mixed grassland in this study) located in the southwest corner of the NWTC. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal designation or regulatory enforcement. It is made primarily for management purposes. This area of the NWTC is not impacted by research or construction activities on the site.

The survey identified eleven noxious weed species on the NWTC site. Five of these are recognized as belonging to the top ten prioritized weed species in Colorado. Based on the survey, recommendations were made to continue using a comprehensive weed management program, based on integrated pest management (IPM) philosophy.

The survey showed the native seed mix used for revegetation at the NWTC to be very successful in many areas of the site. NREL is continuing the use of this seed mix for revegetation at the NWTC.

Weed control efforts have been ongoing since 1997 at the NWTC and 1998 at the STM site. NREL uses an IPM approach that incorporates various types of weed control methods. Some of these include mechanical practices (e.g. mowing), cultural (reclamation of disturbed areas), prevention (e.g. limiting or eliminating driving of vehicles off established roadways), and herbicide treatment. The effectiveness of control methods is periodically assessed. The use of multiple strategies for control has been successful in significantly reducing populations of diffuse knapweed and Canada thistle on the sites. The key aspect of the weed control program is to maintain flexibility to respond to the changes in weed populations from year to year.

In 1998, aerial herbicide application of Tordon 22K was conducted using helicopter application over about 200 acres of the NWTC to target diffuse knapweed. It has been very effective in controlling the weed, and healthy stands of native grasses have proliferated with the decrease in weed competition. Since that time, infested areas of the NWTC have been treated using ground application with herbicide. More information regarding 2003 herbicide application is provided in Section 5.10.3.

Weed infestations at the STM site are much less severe than at the NWTC. Limited ground application of herbicides has been conducted at the STM since 1998.

#### *5.10.2 Permitting*

There is no permitting applicable to vegetation management, although there is a State weed law that requires property owners to control certain species of invasive weeds (e.g. diffuse knapweed). For application of certain types of herbicides designated as “restricted use” by EPA, a certified applicator must be used. Herbicide applications at NREL are always performed by a certified applicator. The exceptions are herbicides used for control of undesirable vegetation along walkways, roadways, and adjacent to facilities. These are typically Round-Up and Weed-B-Gon and are applied by NREL Site Operations staff according to an NREL Safe Operating Procedure (SOP).

#### *5.10.3 2003 Activities*

NREL routinely practices IPM using various weed control methods, as described in the previous section. These are implemented during the normal course of site operation. In addition to the reclamation, offroad driving restrictions, and other weed control methods, limited ground applications of herbicides occurred at the NWTC and STM in the spring of 2003 and 2004. At the NWTC, spot spraying using tractor and backpack applicators was performed. Primary target weeds were diffuse knapweed, Leafy spurge, Canada thistle, common teasel, hoary cress, sulfur cinquefoil, and St.

Johnswort. At the STM, target weeds were mainly diffuse knapweed and Canada thistle.

NREL promotes the sustainable management of its government-owned land by implementing environmentally sound, cost-effective landscaping practices that reduce adverse impacts to the natural environment while providing essential shade and cooling for indoor and outdoor spaces and a more aesthetically appealing appearance for the sites. In order to formalize this commitment, NREL completed a new Sustainable Landscape Design and Management Program in 2003.

## 5.11 Wildlife

### 5.11.1 Program Management

Wildlife habitat at the STM site is comprised of grasslands, shrublands, and wetlands. The Colorado Division of Wildlife has estimated that these habitats may support up to 14 species of reptiles, 36 mammal species, 82 bird species, and four amphibian species. However, due to the lack of aquatic sites, the presence of amphibians is unlikely. A resident population of mule deer inhabits the STM site. One or two mature cottonwood trees are located in the upper sections of site drainages and provide perching sites for raptors such as red-tailed hawks and owls. Common wildlife found at the NREL STM site are listed in the following table.

**Table 5.3 – Common Wildlife Found at the South Table Mountain Site**

<b>Mammals</b>	
Coyote	<i>Canis latrans</i>
Deer mice	<i>Peromyscus maniculatus</i>
Desert cottontail	<i>Sylvilagus auduboni</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Mexican woodrat	<i>Neotoma mexicana</i>
Mountain cottontail	<i>Sylvilagus nuttalli</i>
Mule deer	<i>Odocoileus hemionus</i>
Prairie vole	<i>Microtus ochrogaster</i>
Red fox	<i>Vulpes vulpes</i>
<b>Birds</b>	
American goldfinch	<i>Carduelis tristis</i>
American robin	<i>Turdus migratorius</i>
Black-billed magpie	<i>Pica pica</i>
Chipping sparrow	<i>Spizella passerina</i>
Dark-eyed junco	<i>Junco hyemalis</i>
European starling	<i>Sturnus vulgaris</i>
Great Horned Owl	<i>Bubo virginianus</i>
Green-tailed towhee	<i>Pipilo chlourus</i>
Horned lark	<i>Eremophila alpestris</i>
MacGillivray's warbler	<i>Opoornis tolmiei</i>

Mourning dove	<i>Zenaida macroura</i>
Raven	<i>Corvus corax</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Vesper sparrow	<i>Pooecetes gramineus</i>
Western bluebird	<i>Sialia mexicana</i>
Western meadowlark	<i>Sturnella neglecta</i>
<b>Reptiles</b>	
Bullsnake	<i>Pituophis catenifer</i>
Eastern fence lizard	<i>Sceloporous undulatus</i>
Plains garter snake	<i>Thamnophis radix</i>
Prairie rattlesnake	<i>Crotalus viridis</i>

Source: NREL (Dames & Moore), 1999, and NREL (ERO), 1998.

A wildlife survey was conducted on the STM sites in 1987. Follow-up verification surveys were conducted in 1998 and 1999. A new site-wide wildlife survey is currently underway, and is described in Section 5.11.3.

Field research into avian use of the NWTC was conducted during 1994 and 1995 in an effort to identify potential impacts on birds from wind-turbine research. While several species of raptors, including red-tailed hawks, kestrels, and a great-horned owl were noted on the site, they were primarily transient in nature. The NWTC appears to be used primarily for resting and hunting, although one pair of kestrels nested in an old concrete pole during the spring. Birds of prey of concern, such as eagles, generally fly in excess of 152 m (500 ft) over the site. No significant impacts to the birds from NREL activities were found.

A year-long monitoring project for birds and bats was initiated on the NWTC in early 2001. Standardized plot surveys were conducted to survey songbirds and raptors on the NWTC and adjacent, undeveloped areas. NREL also conducted systematic searches of turbines and meteorological towers on the NWTC to document avian mortality. The study was completed in July 2002. Salient findings of the study were as follows (Schmidt, E., *et al.*, 2003):

- Abundances of individual raptor species on the NWTC site were similar to surrounding areas. However, the average number of species detected per count at the NWTC was nearly double that of surrounding areas in winter, the season when raptors are most abundant in the region. This difference is likely attributable to increased availability of perches at the site. Raptors flew and perched higher at the NWTC than in adjacent areas, again probably related to the wind turbines and other structures at the site.
- Only 1 of 46 bird species counted on grassland plots during this study differed in abundance between the NWTC and adjacent areas – the horned lark, which was about 16 times more common off site. This difference is attributable to cattle on Boulder Open Space creating low-stature grasslands preferred by this species.

- Bird abundance and variety on the...[newly acquired 25-acre parcel, south of the previous NWTC boundary] slated for future use were generally similar to the developed areas, except for the relative scarcity of raptors on the undeveloped site, which probably was due to a lack of perches.
- The NWTC does not support a large diversity or abundance of bat species (possibly six species of bats use the site), but an area on the northwest side of the site, with trees close to a rocky outcrop, provides foraging and perhaps roosting habitat.

No raptor carcasses [were found] during the 12-month survey of the NWTC, except one American kestrel that had died before the study started. Bird mortality associated with the site appears to be minor. Extrapolating from four passerine (songbird) carcasses found during the searches, estimated annual bird mortality attributable to the NWTC was 24 individuals, all songbirds (Passeriformes). Most of these deaths were probably the result of collisions with support wires for the meteorological towers rather than the turbines themselves. No evidence [was found] of bat fatalities at the site.

#### *5.11.2 Permitting*

NREL has no permitting requirements for this area of environmental management.

#### *5.11.3 2003 Activities*

A site-wide wildlife survey of the STM site was begun in April 2004 and will be completed in June 2005. The objectives of the survey are to update existing data in light of expanded development of both the site and the surrounding area, and to develop best management practices for future construction projects to maximize protection for site wildlife.

The survey includes large and small mammals, predators, migratory birds and raptors, upland game birds, and invertebrates identified on an opportunistic basis (i.e. only as they are found during other surveys). To date, no unexpected species have been identified, and no threatened or endangered species have been identified. The final results of the survey will be discussed in the 2004 Annual Environmental Performance Report.

### **5.12 Endangered Species/Species of Concern**

#### *5.12.1 Program Management*

The Endangered Species Act provides for the designation and protection of wildlife, fish, and plant species that are in danger of extinction and preserves the ecosystems on which these species depend. A wildlife survey was completed on the STM site in 1987 (The FORUM Associates, Inc., 1987a), at which time no threatened or endangered species or candidate wildlife species

for endangered designation were found. A vegetation survey of the STM site was completed in 1999 for the *National Renewable Energy Laboratory (NREL) Site Conservation Easement Baseline Inventory* (U.S. DOE 1999). No threatened, endangered, or candidate plant species were identified in the survey.

Additional surveys of wildlife on the Conservation Easement property were conducted in 1999, also for the Baseline Inventory. The U.S. Fish and Wildlife Service lists five threatened and endangered animal species that may potentially occur in the property area, including American peregrine falcon, bald eagle, Eskimo curlew, Mexican spotted owl, and Preble's meadow jumping mouse. The Colorado Natural Heritage Program database lists three animal species of interest that may potentially occur in the property area, including common shiner, arogos skipper, and ottoe skipper. No suitable habitat is present for any of these species on the Conservation easement property.

No threatened, endangered, or candidate species of either plants or animals have been identified to date on the NWTC site. A vegetation survey conducted between August 1999 and August 2000 identified a small area of xeric tallgrass (defined in the survey as mesic mixed grassland) prairie located in the southwest corner of the NWTC site. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal designation, but is made primarily for management planning purposes. This xeric tallgrass prairie area has been designated by NREL as a Conservation Management Area. Most of the Conservation Management Areas on the NWTC are formally designated as areas on which building will not occur. However, as the xeric tallgrass prairie is in the active turbine testing area, it is not reasonable to preclude all development on portions of the site inhabited by this plant community; but disturbance will be minimized on the area.

A 3-season vegetation survey was completed on the STM site in May 2002. Details of the survey are presented in Section 5.10.1. The survey found no rare/or imperiled plant species on the site, but areas of mixed foothills shrublands (also called tall upland shrubland), were identified along the top of the mesa within the Conservation Easement area. That natural community is listed as rare and imperiled by the Colorado Natural Heritage program. It is within a designated conservation easement area where no development will occur except planned trails being established by Jefferson County Open Space (See Section 6.0 for a discussion of trails) .

#### 5.12.2

### Permitting

NREL has no permitting requirements for this area of environmental management.

#### 5.12.3 2003 Activities

As reported in Section 5.11.3, a site-wide wildlife survey of the STM site is ongoing. To date, no threatened or endangered species have been identified.

### **5.13 Wetlands/Floodplains**

Limited wetland areas totaling less than 0.3 ha (0.75 ac) occur on the STM site in the drainage bottom located north of the Visitor's Center. These are narrow, linear wetlands supporting spikerush, baltic rush, sedges, bluegrass, hemlock, and field mint. These wetlands will be protected from adverse impacts as site development continues.

Wetland areas at the NWTC are extremely limited in extent as well. These areas, along the site's eastern boundary, total less than 0.4 ha (1 ac).

According to maps generated by the Jefferson County Department of Highways and Transportation as part of its urban drainage studies, NREL's STM site does not contain any floodplains, and no floodplains have been identified at the NWTC. As a best-management practice, however, all construction activities that may cross a drainage channel are designed to meet the 100-year flood control standards (designed to withstand the equivalent of a 100-year flood).

### **5.14 Cultural Resources**

#### 5.14.1 Program Management

Cultural resources are defined as any prehistoric or historic district, site, or building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or any other reason. Cultural resources can be divided into three major categories:

1. Prehistoric and historic archaeological resources.
2. Architectural resources.
3. Traditional cultural resources.

Prehistoric and historic archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., arrowheads, bottles). Prehistoric resources that predate the advent of written records in a region range from a scatter composed of a few artifacts to village

sites and rock art. Historic resources may include campsites, roads, fences, trails, dumps, battlegrounds, mines, and a variety of other features.

Architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for protection under existing cultural resource laws. However, more recent structures, such as Cold War facilities, may warrant protection if they manifest the potential to gain significance in the future.

A traditional cultural resource can be defined as a property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that are rooted in the community's history and are important in maintaining the continuing cultural identity of the community. Traditional resources can include archaeological resources, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of their traditional culture.

Cultural resources are protected under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Significant cultural resources are either eligible for, or listed on, the National Register.

Three formal surveys of historic and cultural resources have been performed on the STM site. These surveys were completed in 1980, 1987, and 2003 (see Section 5.14.3 for more detail about the 2003 survey). Two additional surveys of the Camp George West district involving the STM site have also been conducted.

As a result of these STM surveys, three historical sites were recognized as significant cultural resources that should be preserved. These sites include an open-air amphitheater, a stone bridge spanning a natural drainage channel adjacent to the amphitheater, and a stone and concrete ammunition bunker below the amphitheater site. The three structures were constructed during the Works Progress Administration (WPA) era in the 1930s. Through NREL's efforts, these sites have been added to the National Register of Historic Places (National Register), with the amphitheater and stone footbridge listed together as a single site. NREL also participated in an interagency survey of South Table Mountain and Camp George West to identify historic structures and sites eligible for nomination to the National Register.

The Camp George West Historic District, located south of the STM Site's Denver West Parkway, was also listed, and includes the 25-acre parcel recently transferred to NREL. Two architectural resources, firing range lines and low rock walls, have been identified on that 25-acre parcel on NREL's STM Site that contribute to the Camp George West Historic District.

An archaeological survey of the NWTC site was conducted in support of the 1996 Environmental Assessment to supplement previous surveys so there were no gaps in cultural surveys on the site. No significant historical or archaeological resources were identified. However, the wooded ridge area on the west portion of the site was identified as a location with potential for cultural resources, so further testing or observation during excavation would be done should there be any future need for work in the utility corridor in the vicinity of the ridge.

Should any evidence of cultural resources be discovered at any time during ground disturbing activities at the STM or NWTC sites, NREL will stop all work would stop in the vicinity until a qualified archaeologist completely evaluates the significance of the find.

#### *5.14.2 Permitting*

NREL has no permitting requirements for this area of environmental management.

#### *5.14.3 2003 Activities*

During 2003, a cultural resources survey was conducted of the 25-acre parcel south of Denver West Parkway on the STM Site. The survey found that the parcel has the potential for archaeological buried deposits and should be systematically tested prior to construction.

The Camp George West Historic District overlaps the NREL STM property by 25 acres. Two contributing resources occur within those 25 acres. Contributing resources are those features within a historic district that contribute to the districts overall eligibility for the National Register. The contributing resources are as follows:

- Two firing lines located on the 25 acres. There are also firing lines located south of the NREL property on land owned by Jefferson County Open Space and proposed for development as the Camp George West Park.
- Portions of a low rock wall are also present on the 25 acres. There is also a rock wall located south of the NREL property.

DOE has consulted with the State Historic Preservation Officer (SHPO) over the resources newly discovered on the 25 acres. DOE and the SHPO have entered into a Memorandum of Understanding in which DOE agrees to perform further surveys to fully document the resources on the 25 acres prior to any development of the parcel.

## **5.15 *National Environmental Policy Act (NEPA)***

### **5.15.1 *Program Management***

Management in this area is consistent with NREL's NEPA Implementation Program (6-2.2).

As a federal agency, DOE is obligated to comply with NEPA by evaluating the potential for environmental impacts prior to conducting its activities. Regulations for compliance with the Act are issued by the Council of Environmental Quality (CEQ). DOE has also issued implementing regulations at 10 CFR that complement the CEQ requirements. DOE has written a site wide Environmental Assessment (EA) for its activity at the STM Site and DWOP, and separate EAs for the NWTC and JSF activities.

NREL has established procedures, with the approval of the DOE GO, to assist DOE in meeting their NEPA obligation. Proposed activities that will be conducted off of NREL's four sites are evaluated for their potential environmental effects using the appropriate level of NEPA review, in conjunction with GO.

The NREL NEPA Handbook has been prepared to provide NREL project managers and procurement specialists with guidance on implementing the NEPA procedures.

### **5.15.2 *Permitting***

NREL has no permitting requirements under NEPA.

### **5.15.3 *2003 Activities***

During 2003, activity continued on developing an EA for one potential site for a geothermal direct use project (district heating system), in Canby, California. The EA process was initiated in 2002 for the Canby, California site, and the EA was completed and a Finding of No Significant Impact (FONSI) signed in early 2003.

In 2001 a subcontractor was hired and began writing the new Site wide EA for the NWTC, and the EA was completed in May 2002.

Internal scoping began in 2001 for the new Site wide EA for the STM site. In 2002 the contractor was hired and began writing the EA. The EA for the STM site was completed and a FONSI signed in 2003.

In addition to the EA activity, numerous NEPA reviews of both onsite and offsite activities occurred through completion of NREL Environmental

Checklists. As outlined in NREL's NEPA implementation procedures, these reviews were coordinated with NREL project managers, subcontracting staff, the NREL NEPA Coordinator, and the DOE Golden Field Office NEPA Compliance Officer. NEPA requirements were also coordinated with future program planning through interaction between NREL's ES&S Office Director and NREL's Technology Program and Project Managers, as well as through participation in the NREL management Annual Operating Plan process and other reviews of proposed projects for the upcoming year.

## **5.16 Radiological Program**

### **5.16.1 Program Management**

Management in this area is consistent with the following NREL programs: Air Quality Protection (6-2.5), and Radiological Control (6-4.5).

All radioactive material at NREL facilities is handled according to NREL's Radiological Control Program. Elements of the program include a radiological control organization, a radiation safety policy and control manual, safe operating procedures, safe work permits, radiological control areas and postings, monitoring, training, and purchasing controls for radioactive materials.

There are no nuclear operations at NREL sites. All of NREL's radiation sources are used/stored in facilities located on the STM site. These include four x-ray diffraction machines at the SERF and two sealed source level gauges at the AFUF used on pilot scale processes to measure the level of material inside process tanks. In addition, two laboratories at the Field Test Laboratory Building (FTLB), on the STM site, occasionally use small quantities of radioisotopes for biological or chemical labeling.

The four X-ray diffraction machines are registered with the State of Colorado and are inspected every two years by a state-licensed surveyor. The surveyor inspects and certifies the X-ray machines and audits NREL's program for radiation safety in connection with operating the machines.

Monitoring of equipment and facilities for removable contamination is performed in the laboratories where radioisotopes are used. Wipe tests are performed on any laboratory surfaces that could have become contaminated by the radioisotope work at least monthly and more frequently if needed. These wipes are analyzed using a scintillation counter.

U.S. Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment," established radiation emission limits for DOE facilities. Such emissions are also regulated by Section 112 of the Clean Air Act as implemented by 40 CFR 61, Subpart H, established by the U.S.

Environmental Protection Agency (EPA). According to 40 CFR 61, Subpart H, all DOE facilities, including NREL, must annually demonstrate compliance with the radionuclide emission limit to the ambient air not exceeding an amount that would result in any member of the public receiving an effective dose of 10 mrem/yr or greater. No radioactive air-emission monitoring is conducted at NREL because of the extremely low usage of radioactive material. Therefore, NREL demonstrates compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR 61, Subpart H, by utilizing the EPA's COMPLY computer model to determine the effective dose equivalent to the public.

All radioactive waste generated during NREL activities is classified as low-level waste. Waste from the STM site is temporarily stored at the Waste Handling Facility (WHF) until disposal is arranged at an offsite facility permitted to accept low-level radioactive waste.

#### *5.16.2 Permitting*

NREL does not have a radioactive materials license from the State of Colorado, as the Laboratory is currently under DOE jurisdiction for radioactive materials handling.

#### *5.16.3 2003 Activities*

During 2003, the total quantity of radioisotopes used was 3.287 mCi used in one laboratory at NREL's FTLB. Any emissions generated by this work were emitted by a laboratory hood exhaust. In addition, much of NREL's radioisotope inventory (including waste quantities) is in containers on which the manufacturer's original seal was broken. In 2003 the potential dose to the public was calculated as though the contents of all unsealed containers was exhausted to the atmosphere, including the amount actually used in 2003. P-32 and S-35 waste that is stored in the Waste Handling Facility and has decayed past ten half-lives was not included in this calculation.

The distance from the source in the FTLB to the nearest potential receptor is 119 m (fence line of nearest resident). For the WHF, the distance from the source to the nearest potential receptor is 311 m.

According to the COMPLY computer model, the potential dose to the nearest member of the public is 0.046 mrem/yr, below the emission limit of 10 mrem/yr, and NREL is in compliance with the NESHAP for radionuclides. Because the dose is calculated rather than measured, it represents a potential or estimated rather than an actual dose.

The resulting calculated off-site whole body doses are small, but are still likely overestimates of potential radionuclide doses. The COMPLY formula assumes

that the entire quantity of the radionuclide in all open containers was released, and that the receptor raises and consumes all his/her own milk, meat, and vegetables at home. These assumptions are extremely conservative.

The total amount of low-level radioactive waste shipped off-site for disposal in 2003 was 209.46 MBq (5.655 mCi) of Carbon-14 and tritium (H-3) waste material.

In 2003 there was no construction or modifications to the labs where radioisotopes are used.

There were no unplanned releases of radioisotopes in 2003.

## 6 CONSERVATION EASEMENT LANDS

During 1999, DOE placed 177 acres of the STM site in a Conservation Easement. The purpose of the Conservation Easement is to preserve the natural character of the property, including its visual, biological, and recreational resources, especially in relation to the changing land uses adjacent to the NREL site and within the region.

The goals of the easement are to:

- Retain, preserve and protect natural, scenic, ecological, and historical aspects of the conservation easement property;
- Protect the ecosystem of the South Table Mountain area and the sustainable habitat for biodiverse vegetation, birds, and terrestrial animals;
- Ensure the scenic and biological integration with adjoining open-space land;
- Prevent further industrial, commercial, or residential development of the conservation easement property; and
- Preserve the conservation easement property as natural open space.

A baseline inventory of the property was prepared in June 1999 to document the current condition of the easement property and to assess the conservation value of the property (Department of Energy, Golden Field Office, 1999). The baseline inventory includes a description of the geographical setting and adjacent property owners, access and use of the property by the public, and a description of the existing environmental conditions of the property (geology, hydrology, vegetation, wildlife, cultural resources). There are also photos incorporated into the report that document the condition of the property.

### 2003 Assessment of the Property

During 2003 there was no NREL activity on the conservation easement property having the potential to degrade the environmental condition of the property. A site inspection was conducted by Jefferson County Open Space, NREL, and DOE during the summer of 2003. No degraded conditions or other environmental issues were found. Photos taken in 2003 showing the representative areas of the easement lands are included in Section 2 of this report.

Jefferson County Open Space has the responsibility to establish and maintain formal trails on the Conservation Easement Property. The trail plan calls for establishing trails in phases. The first phase began in 2004, with Jefferson County Open Space installing two trails from Denver West Parkway (near the NREL Site Entrance) to the mesa top.

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## **8 APPENDICES**

Appendix A – Summary of NREL Environmental Permits, Registrations, Notifications

Appendix B – Above Ground Storage Tank Inventory



## APPENDIX A – SUMMARY OF NREL ENVIRONMENTAL PERMITS, REGISTRATIONS, NOTIFICATIONS

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
<i>Permits</i>								
1	00JE0010L	DOE	AIR	Air Emission Permit for Land Development (fugitive dust from construction activities)	Colorado Dept. of Public Health and Environment (CDPHE)	NWTC site	1/31/05 (issued 3/1/00)	N/A
2	00JE0009L	DOE	AIR	Air Emission Permit for Land Development (fugitive dust from construction activities)	CDPHE	STM site	1/31/05 (issued 3/1/00)	N/A
7	37232	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-1)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
8	37229	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-2)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
9	37228	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-3)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
10	37231	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-4)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
11	37230	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-5)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	None

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
12	214960	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-11)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
13	214961	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-10)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
14	214962	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-09)	Colo Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
15	99JE0400	NREL/DOE	Air	TCPDU air emissions	CDPHE	STM	initial approval issued 7/20/2000	None
16	20030373 thru 20030378	NREL	Permit	Hazardous material storage and use permit	West Metro Fire Protection District	6 STM facilities (Building 16, WHF, SERF, FTLB, AFUF, Shipping & Receiving Facility)	2004	Annual fee, fire dept. inspection; new chemical inventory provided annually

#### *Notifications and Registrations*

17	PWSID Number 230860	DOE	DRINKING WATER	Non-community supply of hauled water from a surface water source	CDPHE	NWTC site	N/A	Periodic chlorine residual testing; monthly bacteriological testing; periodic lead and copper monitoring
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Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
18	CO4890000017	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	DWOP	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	annual fee to Colorado Hazardous Waste Commission
19	CO3890090076	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	STM	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	annual fee to Colorado Hazardous Waste Commission
20	COD980805162	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	JSF	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	none
21	COD983802448	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	NWTC	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	none
22	COR000207563	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	ReFUEL	Issued Jan 9, 2004	none
23	001 and 002	DOE	AIR: OZONE DEPLETING SUBSTANCES	Registration of stationary appliances (2 SERF chillers)	CDPHE	SERF	annual renewal due July 1	none
24	N/A	DOE	AIR: OZONE DEPLETING SUBSTANCES	Facility Notification	CDPHE	STM, NWTC	annual notification and fee due December 1	

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
25	001	DOE	AIR: OZONE DEPLETING SUBSTANCES	Registration of stationary appliance (chiller in DWOP)	CDPHE	DWOP	annual renewal due July 1	
26	2873-001 and 2873-002	DOE	ABOVE GROUND STORAGE TANK	Registration of aboveground storage tanks	Colorado Dept. of Labor	STM--PDU Ethanol Storage Tank, SERF Emergency Generator Tank	annual registration and fee, due April/May	none
27	93000378	DOE	Historic Registration	National Register of Historic Places	National Park Service	Colorado Amphitheater	no expiration	none
28	93000379	DOE	Historic Registration	National Register of Historic Places	National Park Service	Ammunition Igloo	no expiration	none
29	AFP-CO-00255	DOE	Alcohol (not an environmental permit)	Alcohol Producer's Permit	Bureau of Alcohol, Tobacco, and Firearms	AFUF (PDU)	annual renewal due July 1	annual report due Jan 30
30	TF-CO-0331	DOE	Alcohol (not an environmental permit)	Industrial Alcohol User Permit	Bureau of Alcohol, Tobacco, and Firearms	NREL-wide	annual renewal due July 1	none
31	N/A	NREL	Transportation	Hazardous Material Transportation	U.S. Department of Transportation	NREL-wide	annual renewal and fee	none
32	76381	NREL	Registration	X-Ray Machine Certification Report	CDPHE	SERF	Expires 6/06	none
33	68808	NREL	Registration	X-Ray Machine Certification Report	CDPHE	SERF	Expires 2/05	none
34	61007	NREL	Registration	X-Ray Machine Certification Report	CDPHE	SERF	Expires 11/05	none

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
35	7309L	NREL	Registration	X-Ray Machine Certification Report	CDPHE	SERF	Expires 11/05	none

## APPENDIX B - ABOVEGROUND STORAGE TANK INVENTORY

<u>Tank ID</u>	<u>Size</u>	<u>Contents</u>	<u>Class</u>	<u>Use</u>	<u>Date On-Line</u>	<u>Service Status</u>	<u>Date Last Change in Status</u>
No. 1	1010 gallons	Diesel	II	FTLB Emergency Generator (UST)	1983	Closed (6/96)	6/96
No. 2	800 gallons	Diesel	II	SERF Emergency Generator Double-walled, interstitial monitor, no secondary containment	10/93	In-Service	
No. 3	6000 gallons	Ethanol, 50%	IC	PDU Ethanol Storage Single-walled, remote monitoring, 7500 gal concrete containment	12/95	In-Service	
No. 4	564 gallons	Diesel	II	PDU Emergency Generator  Double-walled, interstitial monitor, no secondary containment	8/95	In- Service	6/15/98 OS 9/11/98 IS
No. 5	560 gallons	Diesel	II	FTLB Emergency Generator Double-walled, interstitial monitor, concrete secondary containment	6/96	In-Service	
No. 6	400 gallons	Diesel	II	IUF Emergency Generator Double-walled, no secondary containment	3/97	In-Service	
No. 7	80 gallons	Diesel	II	251 Emergency Generator	1980	PC	
No. 8	500 gallons	Diesel	II	NWTC Hybrid Power Test Bed (HBTB) Convault, pop-up interstitial monitor	6/97	In-Service	
No. 9	500 gallons	Diesel	II	Bldg 16 Emergency Generator Single-walled, no interstitial monitor, 537-gal secondary containment	1990	In-Service	
No. 10	100 gallons	Diesel	II	NWTC NPS Daytank Double-walled, no interstitial monitor	6/96	In-Service	

<u>Tank ID</u>	<u>Size</u>	<u>Contents</u>	<u>Class</u>	<u>Use</u>	<u>Date On-Line</u>	<u>Service Status</u>	<u>Date Last Change in Status</u>
No. 11	100 gallons	Diesel	II	NWTC HPTB North Daytank (SIM#1) Single-walled, no interstitial monitor	6/97	In-Service	
No. 12	100 gallons	Diesel	II	NWTC HPTB South Daytank (SIM#2) Single-walled, no interstitial monitor	6/97	In-Service	
No. 13	50 gallons	Diesel	II	SunWize (West of HPTB) Single-walled, 36-gal steel catch basin	5/98	NC	
No. 14	200 gallons	Diesel	II	251 Stand-by Generator Double-walled, no interstitial monitor	9/98	In-Service	
No. 15	100 gallons	Diesel	II	AFUF Emergency Generator Double-walled, no interstitial monitor	6/94	TC	10/2000 TC
No. 16	50 gallons	Diesel	II	Bergey Hybrid System (Site 1.8) Double-walled, no interstitial monitor	1/00	NC	
No. 17	173 gallons	Diesel	II	NWTC Hybrid 80 (Sim #4) Double-walled, no interstitial monitor	3/01	In-Service	
No. 18	336 gallons	Diesel	II	NWTC Hybrid 125 (Sim #3) Double-walled, no interstitial monitor	3/01	In-Service	
No. 19	500 gallons	Propane	-	NWTC East Met Tower	-	NC	
No. 20	500 gallons	Propane	-	NWTC West Met Tower	-	NC	

<u>Tank ID</u>	<u>Size</u>	<u>Contents</u>	<u>Class</u>	<u>Use</u>	<u>Date On-Line</u>	<u>Service Status</u>	<u>Date Last Change in Status</u>
No. 21	500 gallons	Propane	-	Capstone Micoturbine	-	NC	

Service Status

In-Service (IS)  
 Out-of-Service (OS)  
 Temporary Closure (TC)  
 Permanent Closure (PC)  
 Change-In-Service (CIS)  
 NC—not covered by this Program